# Compressed Air Magazine

MARCH 1956

PUTTING A LIGHT HIGH IN THE SKY

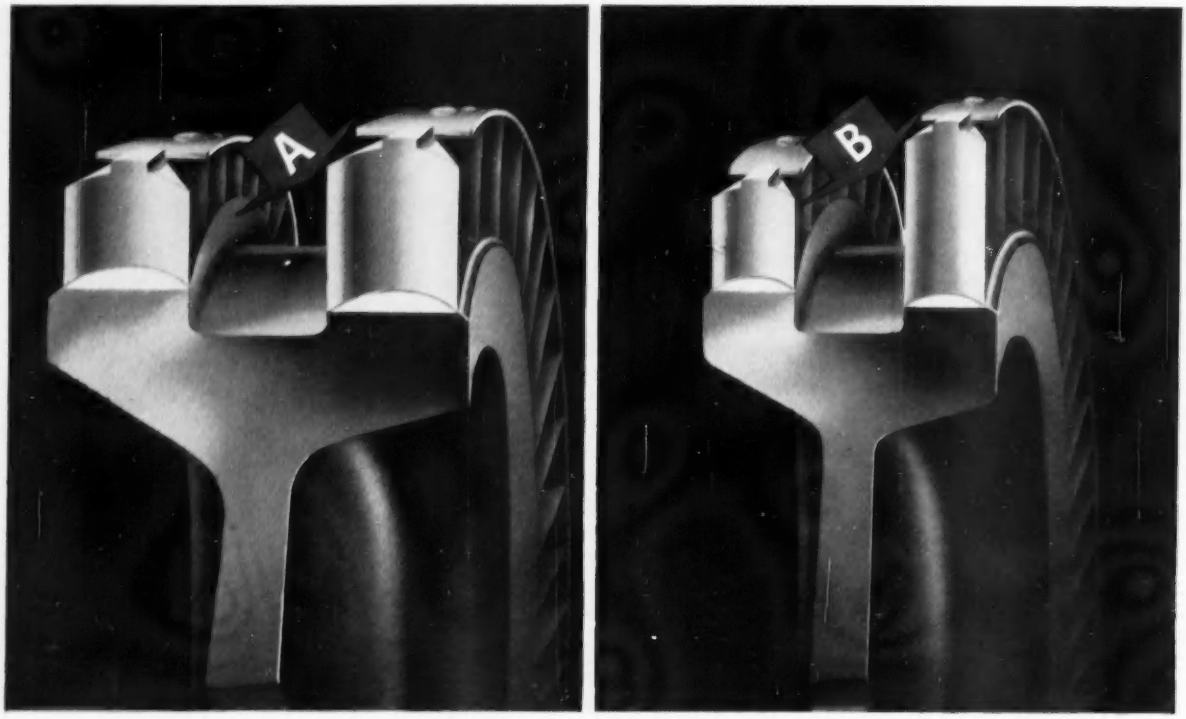
Riggers lower base section of weather indicator to top of Texas Building

(SEE INDEX PAGE)

WIDE WORLD PHOTO

VOLUME 61 • NUMBER 3

NEW YORK • LONDON




*(Left, A) wide bucket "L" type wheel. (Right, B) regular type wheel for Coppus Steam Turbines*

## *Now...for low steam consumption –* **COPPUS TURBINES** *can be furnished with wide bucket "L" type wheel*

Good news for steam turbine users where low steam consumption is important!

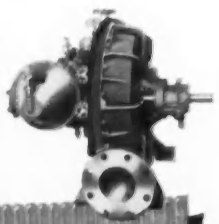
The Coppus Type "L" Wheel is the answer to this problem. Larger turbine buckets are employed to make the most economical use of steam.

In every respect the Coppus Turbine offers the top-quality features and advantages that have made the Coppus line outstanding for efficiency and economy. For example:

- Turbines rated close to your exact hp requirements, from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed safety trip supplementing constant speed governor.
- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.

Coppus Steam Turbines ranging from 150 hp down to fractional, in 6 frame sizes, *make turbine dollars go farther.* Send for Bulletin 135 on Coppus Turbine.

COPPUS ENGINEERING CORPORATION
203 Park Avenue
Worcester 2, Mass.
Sales offices in
THOMAS' REGISTER



# COPPUS "BLUE RIBBON" TURBINES

*Circle 1A on reply card*

*Here is a*

# *Small, Low Pressure*

# PIPE LINE FILTER

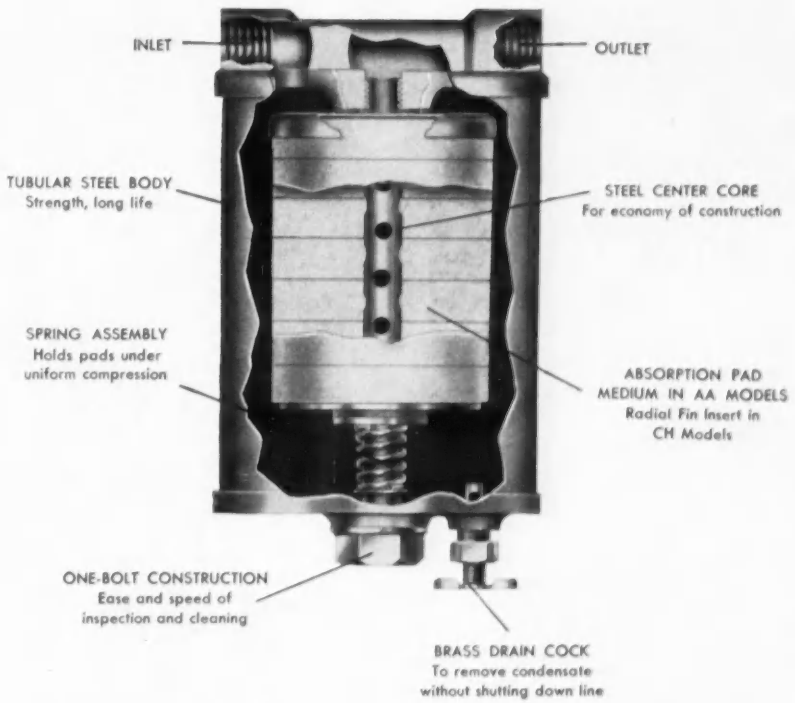
## *with exclusive* STAYNEW *features*

### Designed for low pressures up to 40 psi

NOW . . . a small, practical pipe line filter can be specified for installations requiring only 40 psi maximum pressures for compressed air or gas. Staynew's new low pressure models feature greatly reduced weight and improved, simplified construction . . . plus the many outstanding advantages of *all* Staynew Pipe Line Filters.

Properly installed, these Staynew Filters provide long, trouble-free service; removing the last traces of foreign matter, condensed oil and moisture from compressed air or gas lines.

***Write for Bulletin 210 describing these low pressure pipe line filters.***




***TWO TYPES AVAILABLE***

**1 "CH" MODELS FEATURE RADIAL FIN INSERT.** The Radial Fin Insert, in "CH" Models, effectively removes all foreign matter from air or gas passing through it. Larger *active* filtering area insures *lower* flow resistance. The standard medium will remove particles down to three or four microns (.000156") in size; special media can be supplied for even finer filtration.

**2 "AA" MODELS HAVE ABSORPTION PADS.** Recommended wherever moisture control is a problem—"AA" MODELS, with fine texture felt pads held under uniform compression—assure removal of the last traces of oil and water from lines. The pads form a deep absorptive mass through which air or gas must pass after initial mechanical cleaning.

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

# DOLLINGER

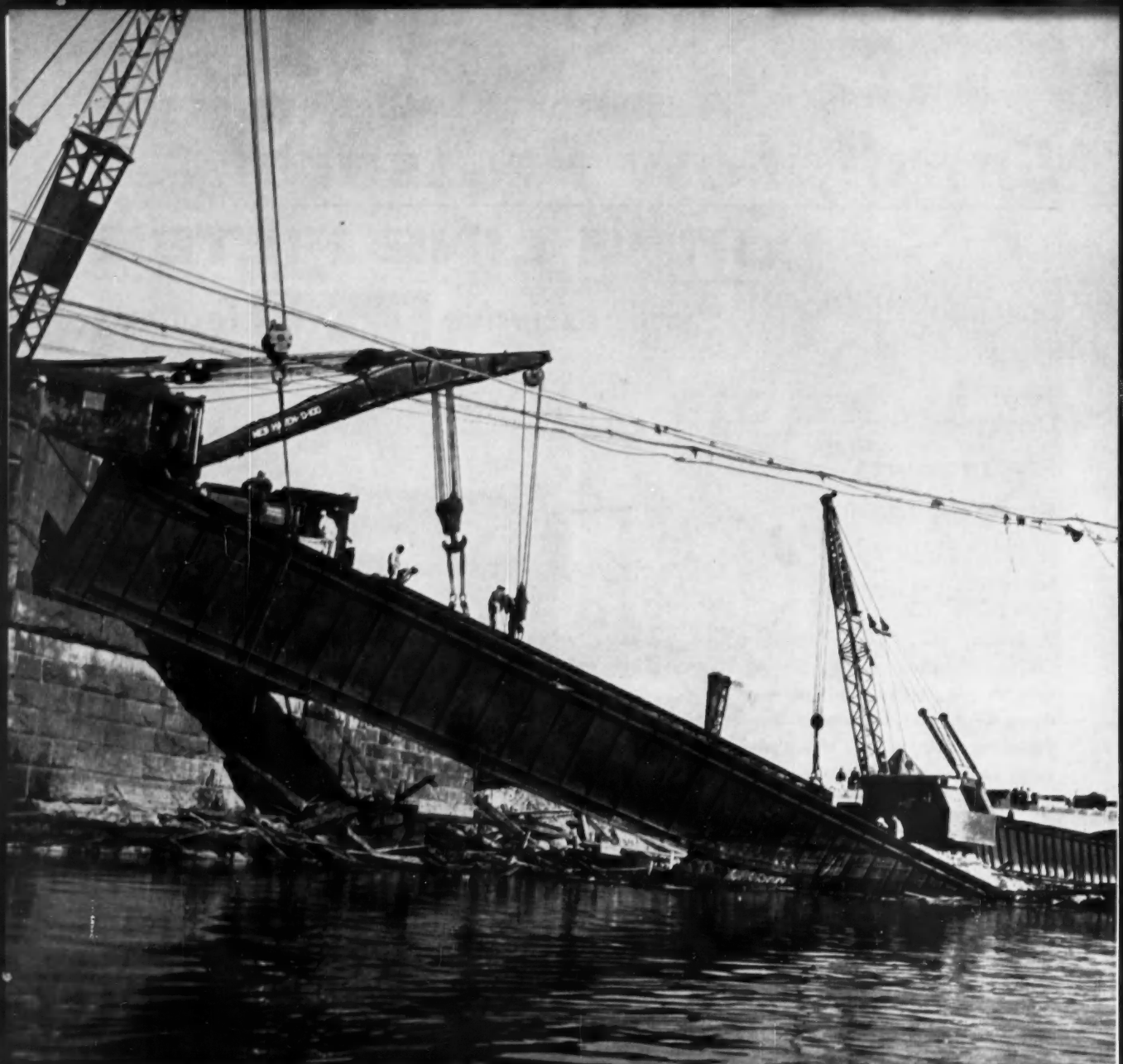
## CORPORATION

**7 Centre Pk., Rochester 3, N. Y.**

**ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED**



*Circle 2A on reply card*



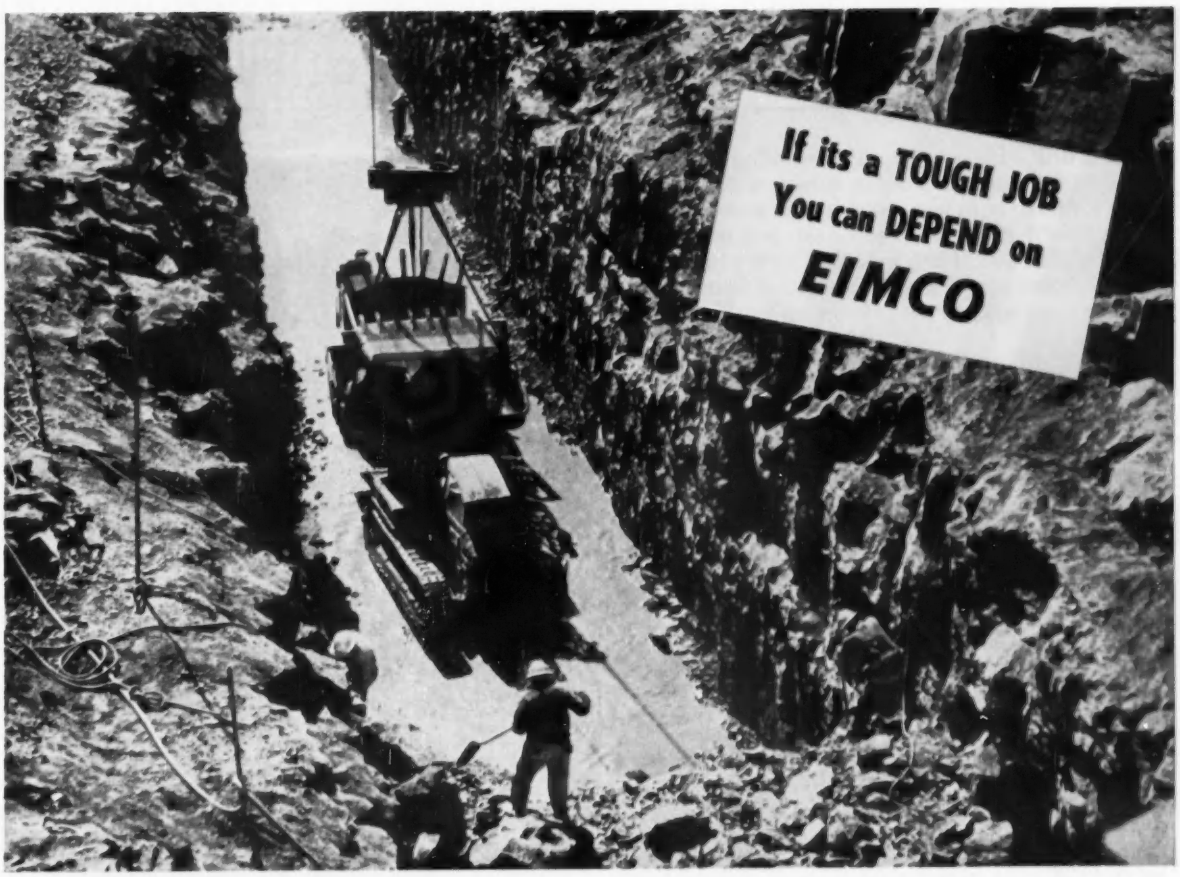
**Wire Rope at Work**—When Hurricane Diane loosed one of the most destructive floods in history, scenes like this were common. The angry torrents swept parts of Pennsylvania, New Jersey, New York, and New England, taking a staggering toll of lives and property. Bridges like the one above, in western Connecticut, were playthings of the raging waters.

Prior to the disaster, this bridge spanned the Naugatuck River. To salvage what was left after the flood, the Foundation Company was summoned from New York, and its hard-working crews and equipment were soon on the job. An emergency shipment of Bethlehem wire rope, ordered by telephone, was rushed to the site of operations; hustled into service. It had the muscle for the tremendous lifts involved, and in no time at all, the work of moving the wreckage was underway.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation *Export Distributor:* Bethlehem Steel Export Corporation

*Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:*

CONSTRUCTION • EXCAVATING • MINING • QUARRYING • PETROLEUM • LOGGING • MANUFACTURING




# EIMCO KEEPS TOUGH EXCAVATION JOB ON SCHEDULE

Contractor — Montag - Halvorson - Cascade-Austin.

Location — The Dalles, Oregon.

Project — The Dalles Dam — Excavation of South Fishway.

Rock — lava basalt 91,000 cubic yards.

Report — Eimco's 105 Tractor Excavator was purchased for this job after several other types of equipment had been tried and proved either entirely unsatisfactory or incapable of maintaining the desired pace. The fishway (shown above) was excavated in lava basalt (typical of this section) with its characteristic flows and faults. Blasting in the faulted zone left many large blocky pieces of rock.

The method successfully used to excavate the shot rock from the 1500 foot long by 15 foot wide fishway channel which was 16′ deep at one end and 60′ deep at the other is as follows: A 6 yard rock ship was lowered by a crane and held in place by a Koehring Dumptor. It was loaded by the Eimco and hoisted out. "This method proved to be the most satisfactory and economical. Both machines took a terrific beating to get this job done, but to this day no one has been able to suggest a better way of doing it."

When it comes to bidding on a tough job — here are a few factors to consider: (1) Cubic yards of tough rock loaded per hour given proper haulage equipment — the Eimco will handle on a comparable basis with boom type shovels 1½ to 2 times its bucket size. (2) Cost—compare the prices. (3) Maintenance — compare these costs on jobs similar to your own. (4) Versatility — The Eimco moves quickly, easily. (5) Labor — compare the productivity per man hour.

Yes! You too will find Eimco's best for the tough jobs.

**THE EIMCO CORPORATION**

**Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City**

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-178



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# how to get the most out of HOLLOW DRILL RODS

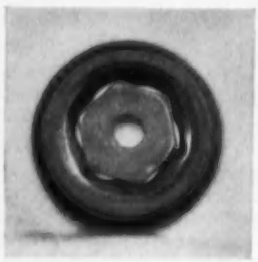
Modern drill rods – especially new *alloy* hollow drill rods like Crucible CA DOUBLE DIAMOND or 4E – give longer drill life than was possible with straight carbon rods. They'll give you lower cost per foot of hole drilled on the job. They will, that is, if you let them. For *abuse* will stop even the best steel from doing its best job. And you pay the price in higher drilling costs.

Rods properly racked and stored give better service.

## *Take, for example,* MAINTENANCE:

*DRILLS* — Pneumatic drills are often so badly in need of repair that good drilling is impossible. Early failure of any rod used in these drills is inevitable. The solution is regular, periodic inspection of all drills and equipment – replacement of worn or damaged parts.

*The damaged and worn striking faces of these pistons prevent impact from being transmitted to the rod in a straight line. Rod failure results.*



*RODS* — It's a temptation to store drills by throwing them into one big pile. Resist it. For nicks and surface damage result – drill failures occur at points of damage.

*BITS* — Keep bits sharp. A dull bit binds in the hole, and drills so slowly that little useful work is performed. But the drill steel must absorb the rugged blows of the hammer.

Proper bit maintenance pays off.

It pays big dividends to make good maintenance a habit. Quality drill steels, like Crucible CA DOUBLE DIAMOND or 4E Alloy Hollow Drill Rods, are made to give long service, lowest cost per foot of hole drilled. They're tough, strong, made to tool steel standards. This *extra* quality assures you of minimum rod breakage, fewer valuable bit losses. But to bring out the best in 'em, you've got to do your part by keeping equipment in shape.

Crucible hollow drill rods are always quickly available in the sizes and types you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

**CRUCIBLE** first name in special purpose steels

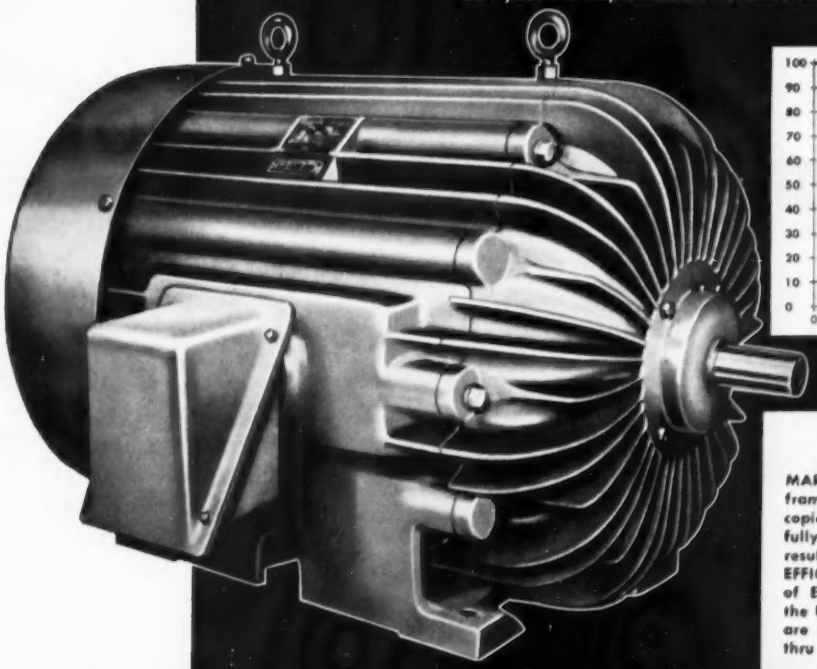
**Crucible Steel Company of America**

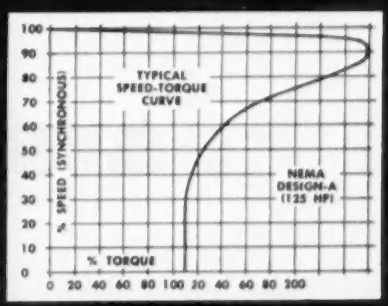
# WHY MARATHON ?

**•EXPERIENCE OF PROVEN PERFORMANCE . . . OVER HALF A CENTURY**
There is no substitute for the reliability of proven performance. Top Names of the Nation's Industry have proven ME performance in ENGINEERING . . . DESIGNING . . . PRODUCING QUALITY PRODUCTS.

**• VERSATILITY WITH A WIDE RANGE OF DESIGN**
MOTORS 1/20 thru 2500 HP . . . GENERATORS ½ thru 2000 KW . . . Single Phase, Polyphase, Direct Current . . . Standard or Special . . . Marathon Electric can design to meet your special specifications.

**• SERVICE THROUGHOUT THE NATION**
MARATHON ELECTRIC has a DISTRICT OFFICE or Representative near you. Call your ME Representative TODAY to help solve your motor problem.






## EXPLOSION PROOF MOTORS

MARATHON ELECTRIC'S familiar ribbed frame construction has already been often copied but never duplicated. This carefully developed rib design formula has resulted in the COOLEST, CLEANEST, MOST EFFICIENT, and MOST COMPLETE RANGE of EXPLOSION PROOF MOTORS to carry the Underwriters' Laboratories Label. They are available in NEMA frame from 56 thru 680 series, from 1/12 thru 250 HP.

All ME Explosion Proof Motors Carry Underwriters Laboratories Inc. INSPECTED Label in 1/12 HP Through 250 HP Ratings

SINCE 1913

# MARATHON ELECTRIC

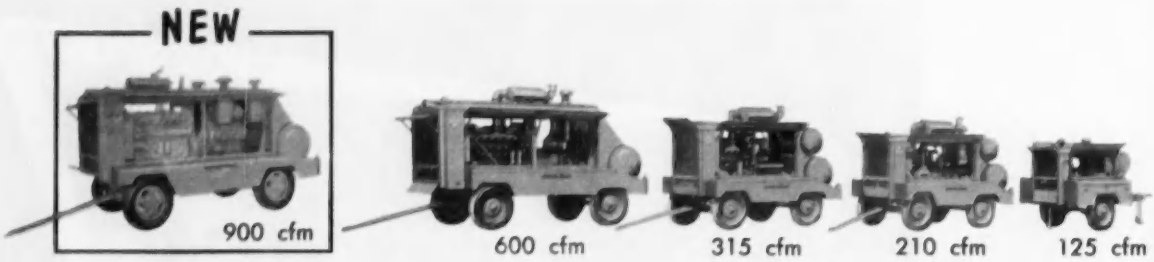
HOME OFFICE AND FACTORY, WAUSAU, WIS. FACTORIES AT ERIE, PA. AND EARLVILLE, ILL.

SALES OFFICES IN PRINCIPAL CITIES

Write or Wire SPADE 58 for further Information



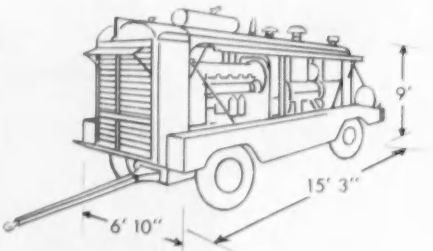
Circle 6A on reply card




## Ingersoll-Rand announces a

# 900 cfm

# GYRO-FLO PORTABLE



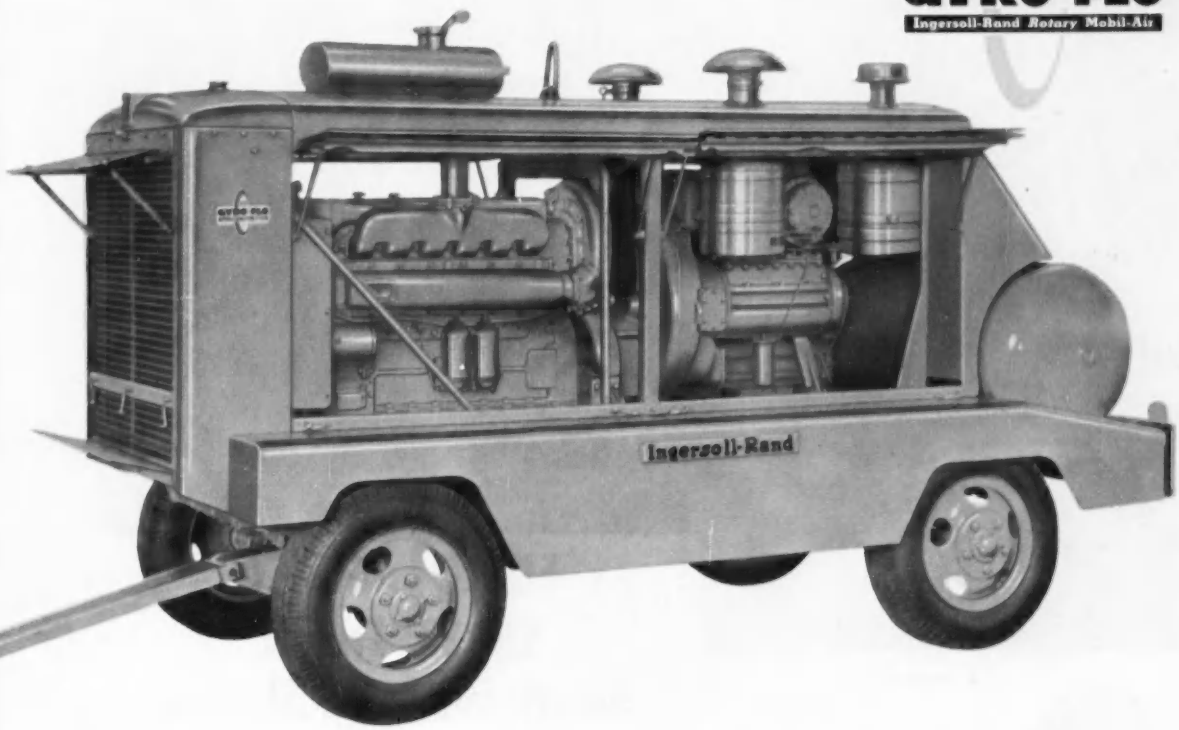

**A LOT MORE POWER IN A LITTLE MORE SPACE**

*There's Only One GYRO-FLO — Ingersoll-Rand's Portable Rotary Compressor Introduced in 1950*

900

**GYRO-FLO**

Ingersoll-Rand *Rotary* Mobil-Air




# ROTARY COMPRESSOR

In this new addition to the time-tested GYRO-FLO line, Ingersoll-Rand brings you a heavy-duty compressor that's designed and built for your big, heavy jobs.

Delivering full 900 cfm at 100 psi, the GYRO-FLO 900 gives you ample capacity to operate ten Jackhamers, seven Wagon-jacks or three Wagon Drills—in a portable unit that weighs only 14,340 pounds ready-to-go. It is only slightly larger than the famous GYRO-FLO 600.

The smooth, dependable and virtually maintenance-free performance of the GYRO-FLO rotary compressor is a matter of 5 years record, on drilling and contracting jobs all over the world. This same outstanding performance and economy is yours with the new GYRO-FLO 900. Where you have a job calling for 900 cfm of air power, and want to bet on a sure thing, ask your Ingersoll-Rand representative to tell you more about the new, heavy-duty GYRO-FLO 900, or ask for Form 2313.

**Ingersoll-Rand**

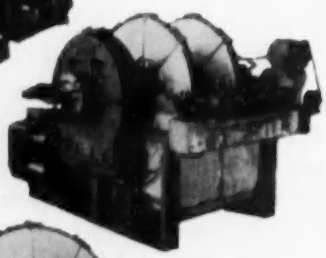
2 373 11 Broadway, New York 4, N. Y.

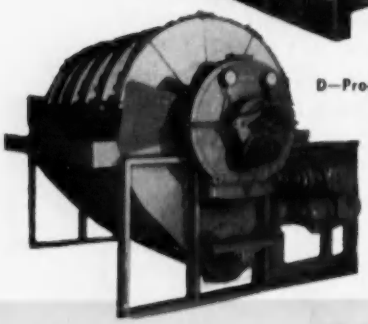
**AN UNBEATABLE COMBINATION . . . GYRO-FLO COMPRESSORS AND I-R ROCK DRILLS**

A—Platform Type

B—Test Model Agidisc

C—Special Disc





D—Production Size Agidisc

# EIMCO AGIDISC SUPER FILTER for Metallurgical Slurries

Eimco Agidisc filters are, by far, the most popular filters in Metallurgical operations today.

There's a reason—that justifies this preference! Agidisc filters do a better job for less money.

Here are some of the advantages:

1. Agidisc Filters give a clean cake discharge.
2. They eliminate messy "build-up" of cake on bag clamps.
3. Eimco Agidisc Filters provide an even distribution of evenly dispersed grain size material over the entire disc surface. This uniformity in thickness provides for greater tonnage, better drying and faster dewatering.

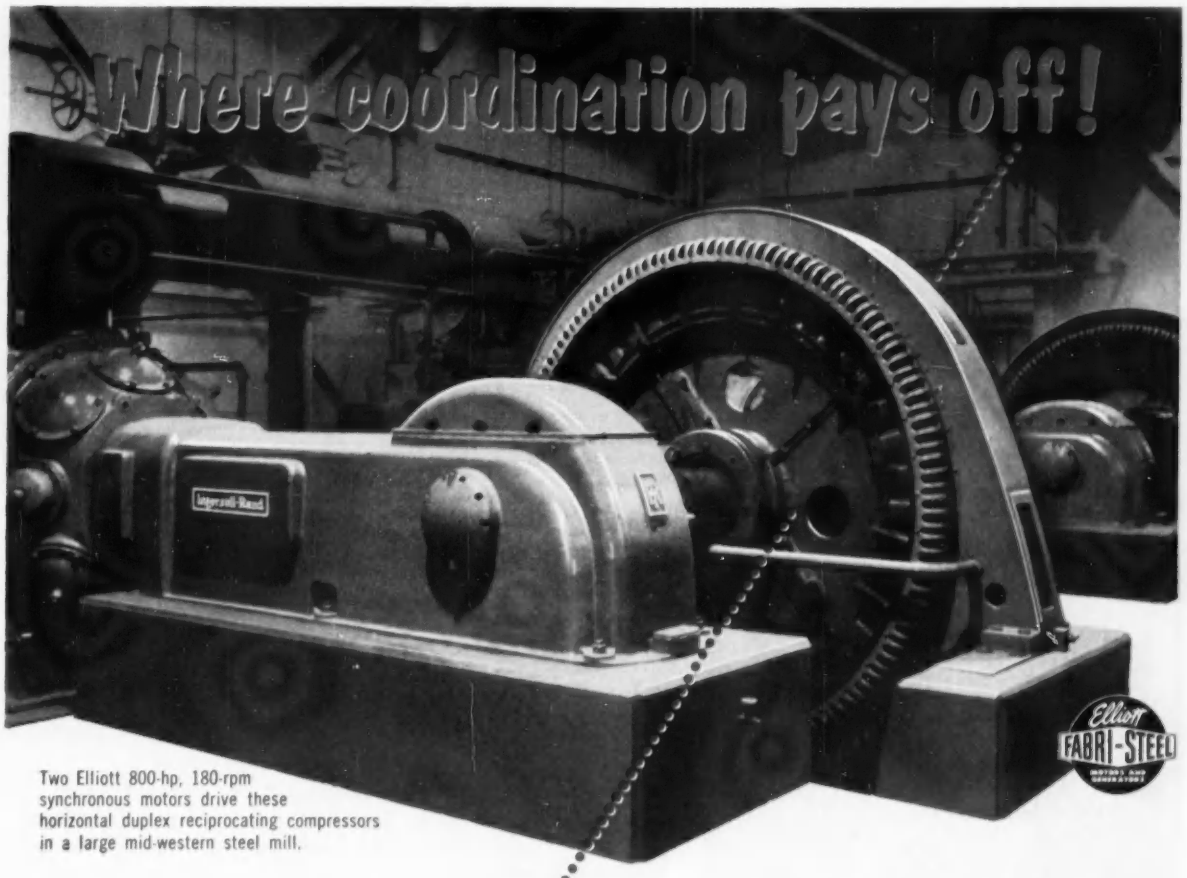
Numerous installations on dewatering of Metallurgical concentrates show Eimco Agidiscs improve tonnage capacity by as much as 22% and give an overall reduction of moisture content in cake by as much as 2% as compared with ordinary filters.

Let us show you an Eimco Agidisc in operation.

**THE EIMCO CORPORATION**

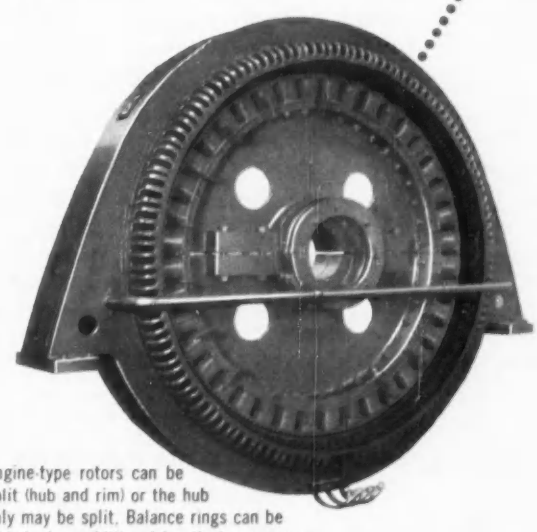
**Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City**

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa




Two Elliott 800-hp, 180-rpm synchronous motors drive these horizontal duplex reciprocating compressors in a large mid-western steel mill.

# ELLIOTT SYNCHRONOUS MOTORS

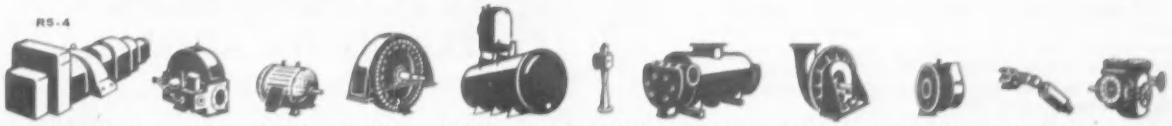


Engine-type rotors can be split (hub and rim) or the hub only may be split. Balance rings can be added when additional inertia is necessary.

team up perfectly with compressors to assure top operating efficiencies. This teamwork is no accident. The complexities of compressor drives require the most careful engineering design and compressor application experience. Elliott has this background as attested by hundreds of successful installations. Such factors as starting torque and current, suitable flywheel effect, as well as power factor correction, are carefully analyzed. The result is the kind of performance that has earned a reputation for Elliott in large synchronous motor compressor drives. Contact your nearest Elliott Field Engineer for full details or write Elliott Company, Ridgway, Pa., for Bulletin PB 5000.

**ELLIOTT Company**

RS-4



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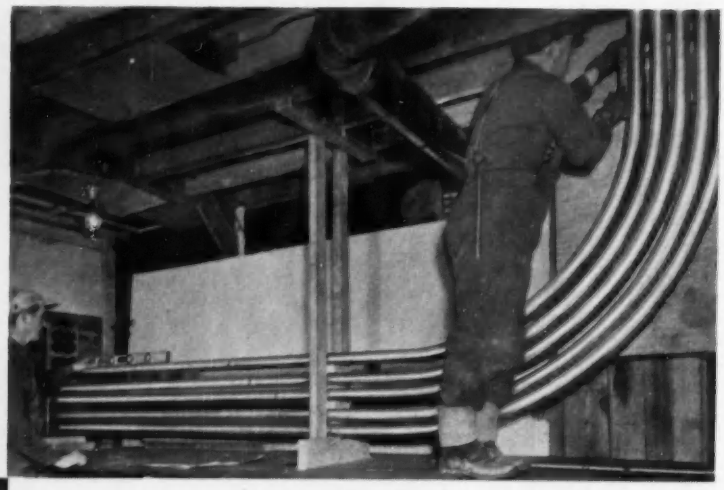
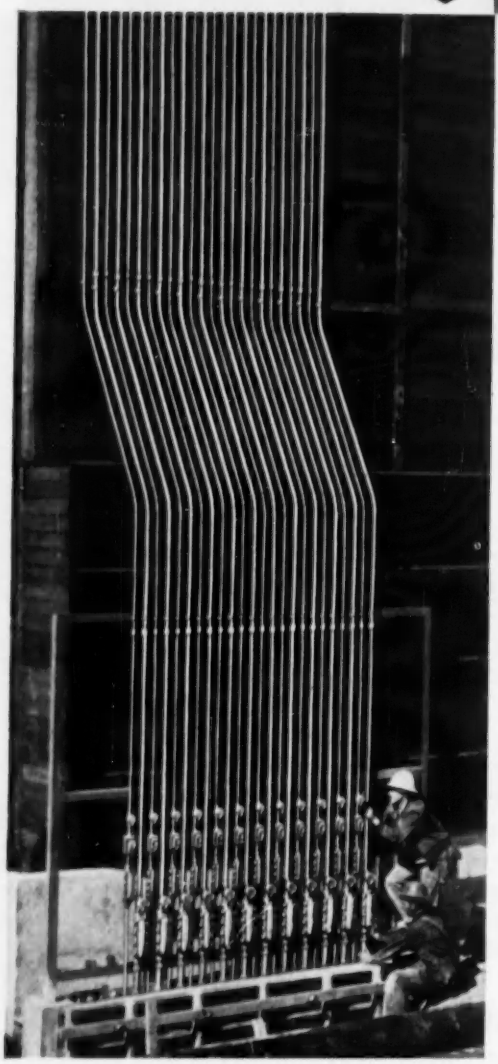
**DOWN** a humid 180 feet below water level at Downsville Dam

**UP** in the corrosive air at a water cooling tower



Some 3600 feet of 2" Everdur Conduit (E.M.T.) protect electric lines in a service shaft plunging down to the release water chamber 180 feet below water level at Downsville Dam of the New York Metropolitan Water Supply System. Electric lines operate vital valves, indicating and communication equipment.



During the War, General Petroleum Corp. saw galvanized conduit fail within a year at one of its plants—replaced it with Everdur Conduit. At its new Ferndale Mobilgas Refinery in Washington, some 12,000 pounds of Everdur Conduit in various sizes guard electric power lines for motors and lighting in this water cooling tower.

# EVERDUR Conduit will guard the electric power lines—for years

**Everdur* Never Rusts.** It offers high resistance to other types of corrosion. That's why Everdur Conduit—made from one of Anaconda's exclusive copper-silicon alloys—is specified for dependable year-after-year protection of electric power lines in industry, on bridges, at power and water supply projects—wherever water and corrosive atmospheres are a problem—or where conduit must be buried or embedded in concrete.

**Everdur is Tough.** In addition to corrosion resistance, Everdur has high physical strength, resists wear and abrasion. It stands up under movement and vibration, as on a bridge, in a subway, in a factory.

**Everdur is Nonmagnetic.** Everdur Conduit creates no magnetic field to produce temperature rise in electric power cables.

Everdur Electrical Conduit is available in two wall thicknesses—R.C. in nominal sizes from ¼" to 4", inclusive, and E.M.T. in nominal sizes ⅜" to 2", inclusive. For more detailed information write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

55120A

*Reg. U. S. Pat. Off.

EVERDUR ELECTRICAL CONDUIT

**ANACONDA®**

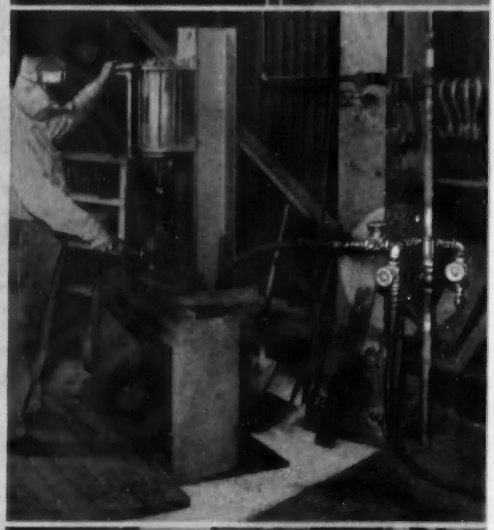
COPPER SILICON ALLOYS

**CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE**



*Circle 10A on reply card*

Hose outlets with quick coupling fittings attached to Grinnell-Saunders Valves at Lehigh Structural Steel Company.

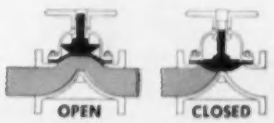


Outlet valves for this rod bender are Grinnell-Saunders.

4-outlet air manifold equipped with Grinnell-Saunders Valves.

# "Lower air costs... increased productivity,

## with Grinnell-Saunders Diaphragm Valves"




At Lehigh Structural Steel Company, compressed air now goes to work—not to waste. Upon discovering that a large percentage of its compressed air supply was being wasted through leakage, this Allentown, Pa. firm began a major review and overhaul of its entire system. The main cause of the trouble was found to be in the outlet valves which could not be kept in proper working condition.

To determine which type valve would stand up best under prevailing service conditions, a number of different valves were installed and the results compared. Based on these impartial "on-the-job" tests, Grinnell-Saunders Diaphragm Valves were approved—and were installed throughout the entire system.

Here is another instance of the economy of Grinnell-Saunders Diaphragm Valves... in use by more and more industries where low maintenance, long service, and complete dependability are demanded.

Features: complete isolation of working parts, leak-proof closure even with grit or scale in line, high lift for full streamline flow, freedom from clogging, choice of diaphragm materials and body linings to suit service, and easy maintenance.

QUICK-ACTING, ¼-turn bonnet

# GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

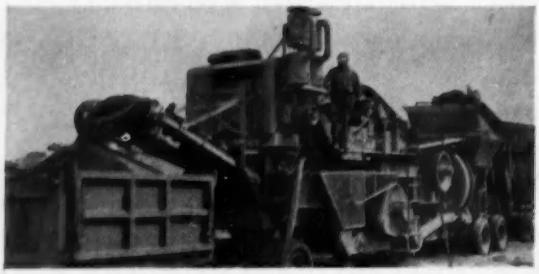


Circle 11A on reply card

# For Lower Costs on
# SPECIFY GM
## In ALL Your

**PRODUCTION DOUBLED—FUEL COSTS CUT 33⅓%**

When Clark & Sons Sand & Gravel Company switched to a GM 2-cycle Detroit Diesel properly engineered for this dredge, production jumped more than 200% and fuel costs dropped one third. GM Detroit Diesel weighs half as much as engine it replaced, starts easier, too.



**FUEL COSTS $1.18 PER HOUR**

And that's "mighty cheap" for a 300-H.P. engine according to Charles Bartelma, Superintendent of Minnesota's Kimmes Construction Company. This GM Detroit Diesel-powered Cedarapids crusher produces 4,200 tons of gravel a day—engine has had no repairs in 2½ years.

**PRODUCTION UP 30%—FUEL COSTS CUT 40%**

When Calumet Paving Company switched to a GM Detroit Diesel on this paver they got an engine that "starts easier, performs better, costs less for fuel and maintenance." Company also operates two other pavers and three crawlers—all GM Detroit Diesel-powered.

**15 YEARS' SERVICE AND STILL GOING STRONG**

The GM Detroit Diesel in this Koehring shovel went to work for Paul Frank, Inc., in 1941—is still giving "economical, trouble-free service." Owner calls engine an "excellent investment, considering low first cost, operating economy and long life between overhauls."

**OPERATES 20 GM DETROIT DIESELS**

Ohio road-builder A. J. Baltes, Inc., operates 20 GM Detroit Diesel engines powering shovels, cranes, draglines and other equipment. Company specifies GM Detroit Diesel power when ordering new equipment—also replaces other engines with GM Detroit Diesels to get "the fundamentals needed for economical operation—performance, economy and service availability."

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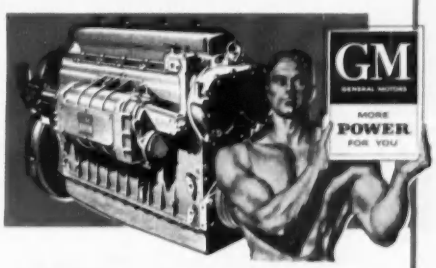


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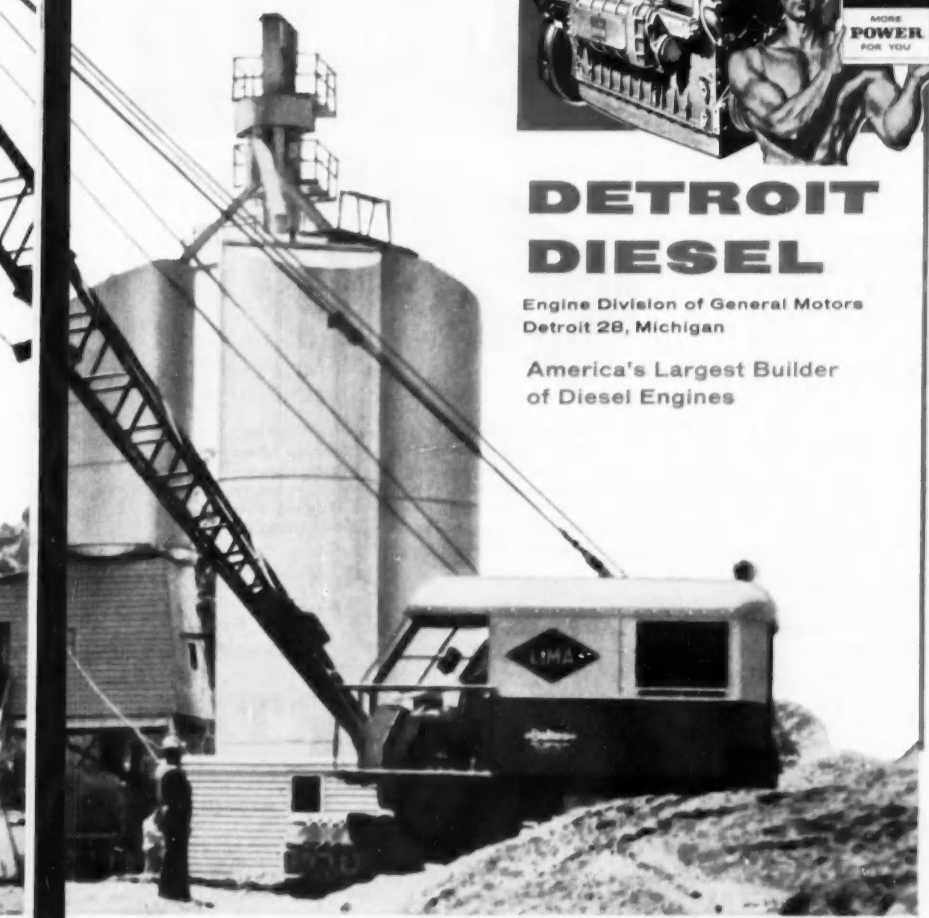

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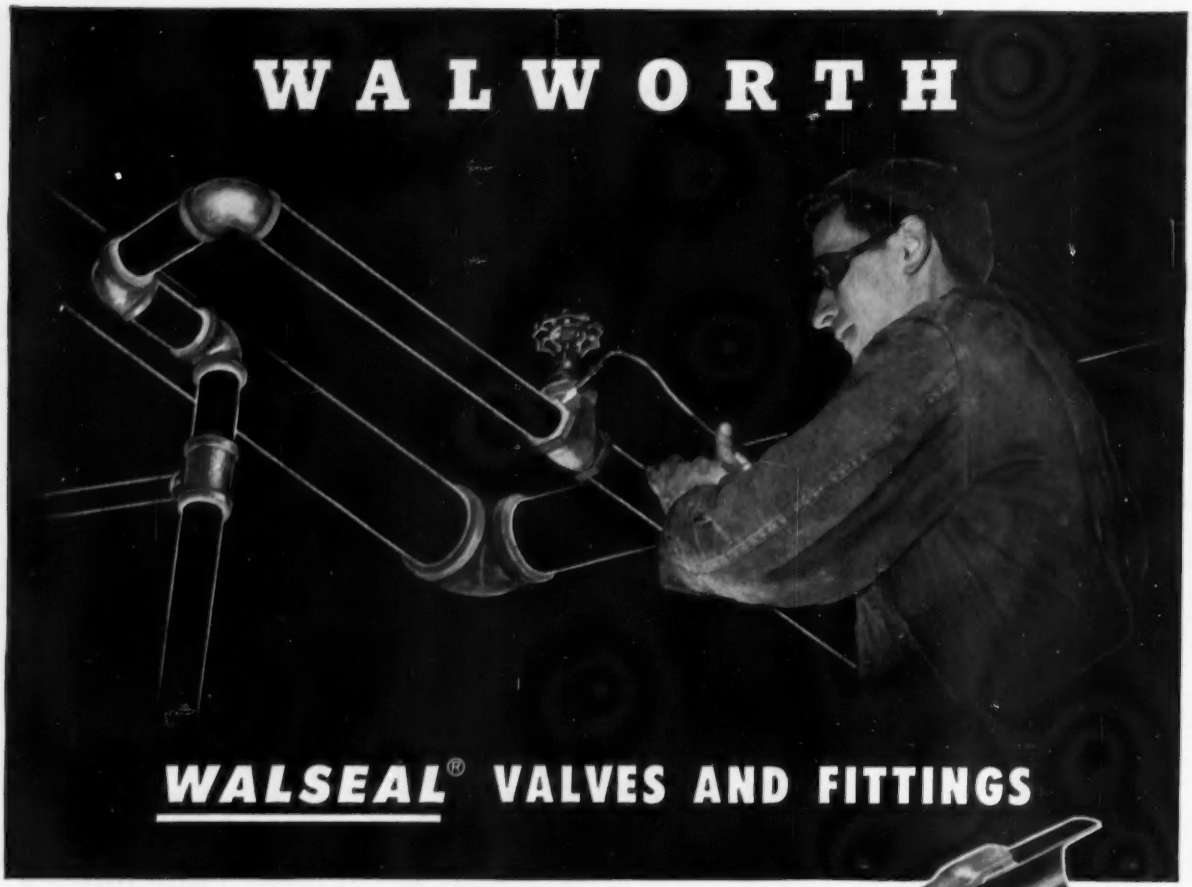

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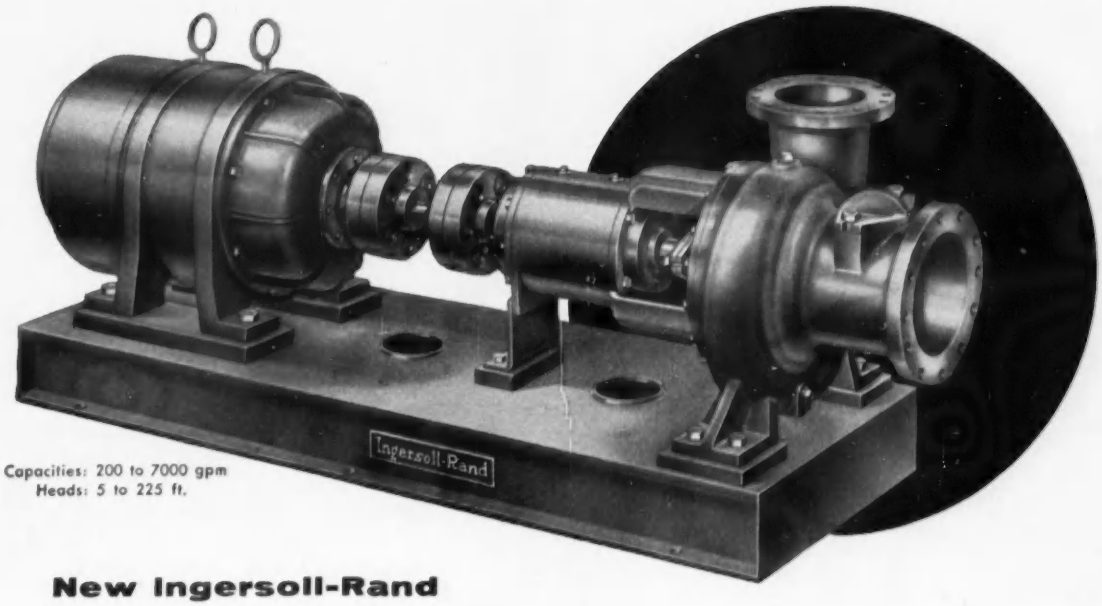


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## ON THE COVER

ATOP the 18-story El Paso Natural Gas Building, in El Paso, Tex., is a 21-foot-high "flame" that tells the community by color code what sort of weather is in store. A red glow means warmer, a gold one cooler, a blue one no change. A flicker forecasts rain. The Plexiglas and stainless-steel light was built in three sections and put together (see cut below) on a platform surmounting the building and 270 feet above ground level. A stiff-leg derrick on the roof and a guy derrick on the sixteenth floor collaborated on the lifting job, which was handled by South Western Transfer Company, Inc. An air hoist was mounted at the lower of the two locations and received its air supply from a compressor on the street. The cover picture and the one on this page are shown by courtesy of Leschen Wire Rope Division of H.K. Porter Company, Inc.

## PARDON US, PLEASE

CLAUDE E. Patch, a member of a Boston construction management firm, rightfully takes us to task for referring to George Dewey, the Spanish-American War hero, as *general*. We did this in noting the fact that Dewey failed to get a vote for membership in the Hall of Fame. "Robbed of his webfooted title of admiral," writes Mr. Patch, "how could he get a vote? It's a slander on the Navy!" We have no defense. Here's hoping that the doughty admiral gets a lot of votes in the next election.

•

THANKS also to Charles A. Norman, of Decatur, Ill., for informing us that Edward H. Faulkner, and not Louis Bromfield, wrote *Plowman's Folly* referred to in our January issue.


# Compressed Air Magazine

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## EDITORIAL CONTENTS


They Fix This Water Pipe with Shingles—*Carey Holbrook* ..... 70
Ground Corncobs Rout Grime ..... 74
Better Metals from Vacuum Metallurgy—*R.J. Nemmers* ..... 76
Cog Railway Valets ..... 81
Steel Mill Housekeeping Aid ..... 82
Roots of a Skyscraper—*Ben A. Green* ..... 84
Editorials—The Scientific Approach—Ghosts from the Past—Another Birthday ..... 86
This and That ..... 87
Trucking Firm Takes Shop to Trailers ..... 89
Machine Assembles Brake Bands As It Turns ..... 89
Industrial Notes ..... 90
Briefs ..... 95
Books and Industrial Literature ..... 97


## ADVERTISING CONTENTS


Adams Co., Inc., R. P. ..... 30
Air-Maze Corporation ..... 21
Anaconda Company, The ..... 12
Bethlehem Steel Company ..... 4, 34
Bucyrus-Erie Company ..... 32
Compressed Air Magazine Co. ..... 31
Conrader Co., R. ..... 30
Continental Motors Corporation ..... 26
Cook Mfg. Co., C. Lee ..... 30
Coppus Engineering Corp. ..... 2nd Cover
Crucible Steel Co. of America ..... 6
Detroit Diesel Division—General Motors ..... 14, 15
Dixon Valve & Coupling Co. ..... 22
Dollinger Corporation ..... 3
Eimco Corporation, The ..... 5, 10, 36
Elliott Company ..... 11
France Packing Co. ..... 24
Galland-Henning Mfg. Co. ..... 29
Grinnell Company, Inc. ..... 13
Hansen Mfg Co., The ..... 37
Ingersoll-Rand Company ..... 8, 9, 17, 3rd Cover
Johnson Corporation, The ..... 29
Lake Shore Engineering Co. ..... 33
Lehigh, Inc. ..... 19
Marathon Electric ..... 7
Naylor Pipe Company ..... 23
New Jersey Meter Company ..... 31
Norton Co. ..... 18
Nugent & Co., Inc., Wm. W. ..... 27
Sarco Company ..... 29
SKF Industries, Inc. ..... 35
Square D Company ..... 31
Texas Company ..... Back Cover
Toledo Pipe Threading Machine Co., The ..... 25
Victaulic Co. of America ..... 28
Walworth Company ..... 16
Wisconsin Motor Corporation ..... 20



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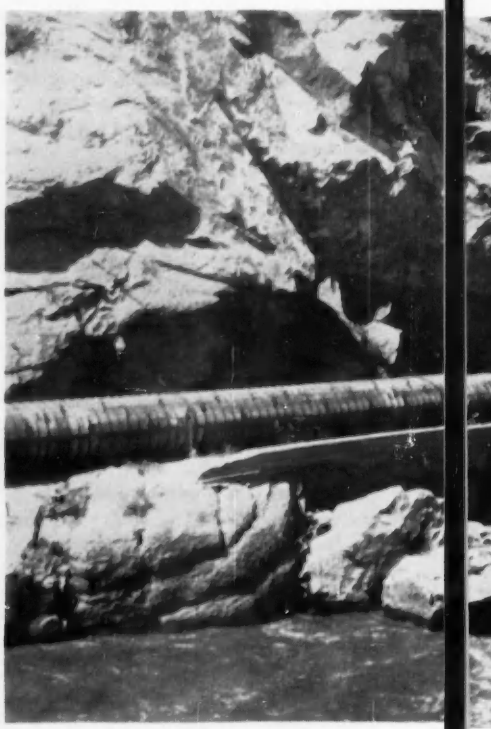
# They Fix This Water Pipe with Shingles

## Wood-stave Line Serving Colorado City Winds Through Royal Gorge of Arkansas River

CAREY HOLBROOK

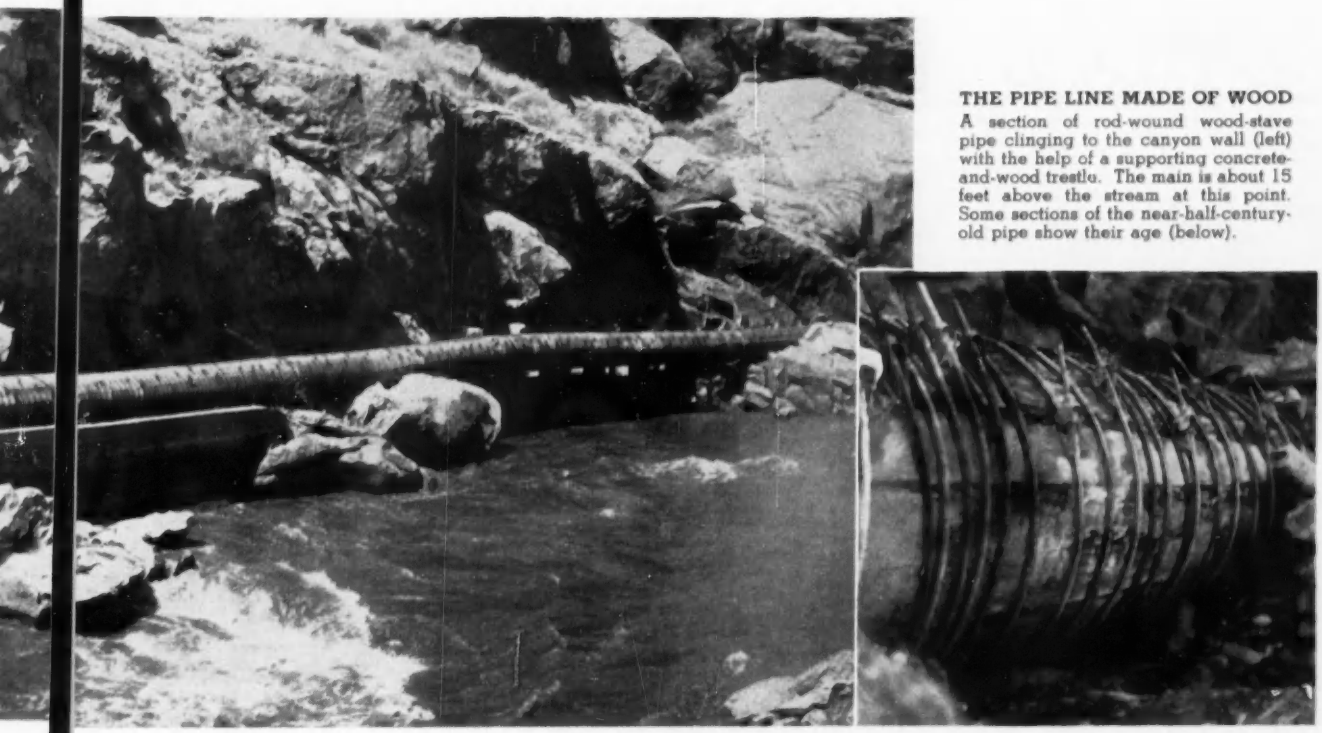


IF YOU were the city clerk handling requistions for the water department and should receive a request for ten bundles of redwood shingles for repairs you would know you were in Canon City, Colo. And if you were the water works superintendent and should get a frantic call from a housewife saying that her yard sprinkler was clogged with sawdust you would be surer than ever that you were in Canon City. For the main pipe line bringing water into this little municipality is a 30-inch wood-stave conduit, part of which was laid in 1908. Redwood shingles are often driven into cracks that may develop in the line, and sawdust is sometimes dropped into it in the hope that it will find its way to some deep down leak and seal it.

Canon City's water supply is taken from the Arkansas River, a swiftly running stream fed by the snows of Colorado's mighty mountains. It flows by gravity from the intake, about 7 miles up in the Royal Gorge, to the pumping plant in town. The fall between these two points is 71 feet. The original water right owned by the city covers 3½ cubic feet and is dated 1859. In 1862 an additional right was obtained for a little more than 19½ cubic feet. This means

**ONLY ONE WAY OUT**

The caretaker's home at the pipe-line intake perches on a steep slope at the bottom of the gorge. There the river flows swift and deep and the swinging foot bridge across it is the only way in or out. On the near side of the stream in the view above are the railroad tracks and above them a twisting path leads up to a clearing big enough for two or three cars. From it a road leads out of the canyon in a steep and tortuous ascent. There is no road, not even a path, leading up to the canyon rim on the side where the house is located. The only level place for a garden is a tiny strip close to the river (top-left). The tomato plants growing there were irrigated with water dipped from the pipe-line settling pond in the foreground. The remainder of the garden is beyond the big rocks.



**THE PIPE LINE MADE OF WOOD**
A section of rod-wound wood-stave pipe clinging to the canyon wall (left) with the help of a supporting concrete-and-wood trestle. The main is about 15 feet above the stream at this point. Some sections of the near-half-century-old pipe show their age (below).

that the community is now allowed to take 23 cubic feet of water per second from the river. Since there are approximately 7½ gallons in a cubic foot, that is more than enough to take care of its needs for a long time.

The water works originally belonged to the Canon City Water Company, a private corporation, but was conveyed to the municipality on July 9, 1884, for a consideration of $60,000. At that time water was pumped from wells and reservoirs, and nearly every user had a filter of some kind to remove sediment. After completion of the gorge line and the necessary reservoirs and filters the water was delivered clear and sparkling. However, a chlorination-treatment system was installed to insure a safe supply. The town once owned all the ranches and water rights on Cottonwood Creek which flows into the Arkansas River about 35 miles west of it, but those holdings were disposed of when the new water works was developed.

In addition to the main city of North Canon with a population of 6375, the municipal plant furnishes water to several other communities. South Canon City, a separate municipality with 1780 residents, was connected in 1911; East Canon with 800 began buying water in 1924; Lincoln Park and Orchard Park, thriving agricultural sections with several thousand consumers, was hooked up to the mains about 1945. All these customers are charged a flat rate of 16 9/10 cents per 1000 gallons of metered water they sell, and each maintains its own bookkeeping and collecting system.

Domestic rates in Canon City proper are based on a sliding scale. Houses with one to four rooms and bath pay $5.50 per quarter. For every room over four, as well as for every extra bath, one dollar per year is added to the bill. Lawn and garden water costs twenty cents per front foot per annum, and no restrictions are in force as to the amount used. The Colorado State Penitentiary, located at Canon City and having a population of about 1600, is also connected to the distribution system but draws on it only in case of emergency because it has its own supply.

The intake for the water works was located in the Royal Gorge because that was the only break in the mountains where a pipe line could be laid. Its construction through this rugged gap was a major engineering achievement. For a distance of 7 or 8 miles the Arkansas River makes its thundering way between towering walls of granite. Starting at Parkdale, the stream travels at the foot of rocky crags that go straight up from the edge of the water in many places. Hard against the confining granite barriers the current carries on a ceaseless battle, and the pinched-in course at the bottom leaves little room for anything except the river.

Through this black and frowning passageway the Denver & Rio Grande Railway laid its tracks. To get a place wide enough for steel and crosstie, the builders tore mighty chunks out of the base of cliffs and dumped them along the water's edge. With steel and concrete, they pushed the river back and gouged out a slim roadbed for their trains. Along this same rough route the water-works engineers set out to carve a foundation for their main wood-stave line.

There was a good reason for selecting a wood-stave instead of a steel conduit. Because of the danger of falling rock and of ice and snow in winter, the line is frequently damaged. In case of a break, repair materials and tools can be brought in by manpower or hoisted up the sheer canyon walls by cables. But no welding equipment could be moved into place to mend a steel pipe, and the task of removing a full 30-inch-diameter length, transporting a replacement section and making the necessary connections without the use of heavy equipment would be a major and expensive operation.

The entire line, from the intake in the gorge to the pumping station in town, is 37,800 feet long, and of this total 13,747 feet is steel pipe 30 inches in diameter. Starting at the intake, first comes an 800-foot stretch of 40-inch line, next 850 feet of 36-inch, and the remainder is 30 inches in diameter. Of the wood-stave pipe laid in 1908 approximately 1½ miles along Tunnel Drive is still in service. At the intake about 1000 feet of the original steel main leading to the settling basin continues to carry its load.

Repairing a system such as this presents problems normally not encountered by a pipe-line crew, for every piece of material needed must be packed along

**SHINGLE DRIVER**

All you need to stop a leak in a wood-stave pipe line are a few shingles and a fellow that doesn't mind getting a shower bath while driving them into the opening. These pictures show a former caretaker putting a miniature geyser under control.

the route on men's backs. Between the intake and the steel bridge which carries the line over the river, a distance of about 1½ miles, there are nine swinging foot bridges anchored to the rock walls and approached by steps or ladders. Sometimes one end of a span is secured right under a hanging cliff, and in order to get off it may be necessary to crawl on hands and knees along a narrow path. These structures, with a 30-inch wide board walkway, bob up and down with every step and sway from side to side in the wind. At each there is a connection with the regular city-owned telephone system so that repair crews, equipped with portable instruments, can plug in and reach the central office in Canon City in case of need.

The traveler who looks out of the car window when passing through the gorge has little idea of the difficulties that were involved in laying the pipe line he sees snaking through the canyon and what it means to keep it in service condition. Between the intake and the steel bridge are also fifteen trestles that carry the main across gaps in the walls. Many of them are only 10 or 20 feet in length, and the longest is 40 feet. All are anchored in the rock and tied to boulders. Some 677 feet of pipe at various points throughout this section just hangs on the faces of cliffs by steel cables. But most of it is simply laid on shelves and secured by steel. There are places with barely enough room for a man to creep along on top of the line, with ledges jutting out over the boiling river 40 to 50 feet below.

In this stretch are fourteen tunnels driven through solid rock. Back in November 1908, when construction there was started, the scale of wages was not so high as it is today. Then, too, convict labor from the nearby state penitentiary was available for the work. In a worn and faded time book owned by Fred Brackney, superintendent of the water works, is a record of what it cost to excavate the passageways by hand. They are about 5 feet wide and 7 feet high—just large enough to accommodate the 30-inch line and allow a man to squeeze in when repairs have to be made. The longest one extends for a distance of 400 feet. The book contains no entries of the laborers' rate of pay, but the total cost of the project was $16,848, which would be considered a bargain today. The job was finished and water cut in on October 8, 1909.

Below the steel bridge at the lower end of the gorge the conduit goes through five more tunnels. Three of these were originally built by the penitentiary for its irrigation system, the others were driven when the water main was laid. The longest one, some 300 feet in extent, and two shorter ones are big enough to carry a full width roadway and are now part of the scenic highway known as Tunnel Drive.

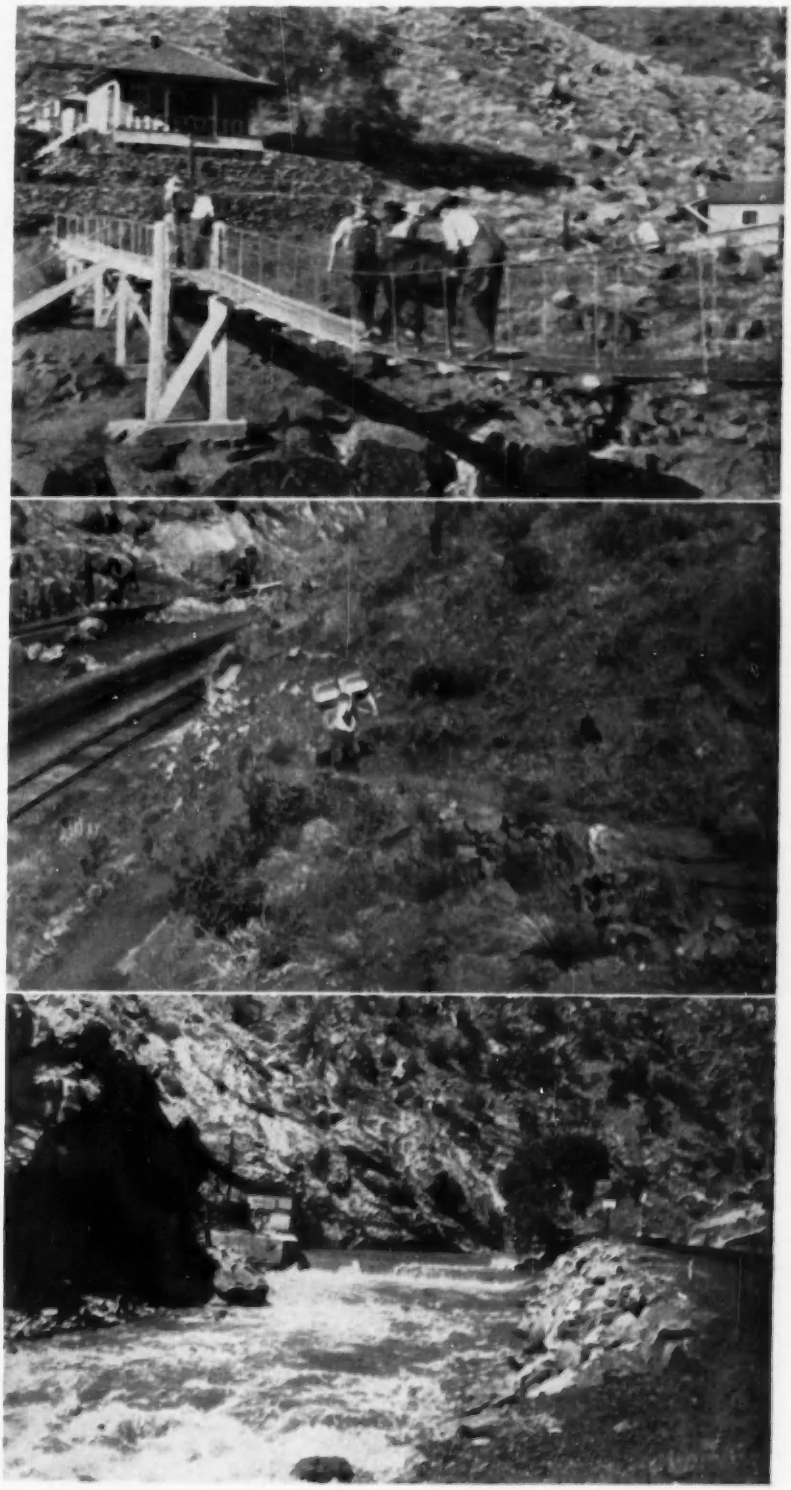
In the operation and maintenance of the Canon City pipe line three men accidentally lost their lives in recent years: the assistant to Superintendent Brackney was crushed to death while trying to free the main from ice; a caretaker at the intake was hit by a falling rock while repairing a leak; and another man put in charge there was killed by a blast of dynamite in trying to remove an accumulation of ice that was blocking the flow of water. A fourth was injured so

badly that he has not been able to resume normal work.

At the intake, deep in the heart of the Royal Gorge, a caretaker is on duty the year round. His house roosts 50 feet or more above the river, with a frowning mountain rising steeply from his back door. Connecting him with the rugged road that leads out in a twisting ascent is a swinging bridge over which everything he needs must be transported. From late September until spring no ray of sunshine warms the dirt in the tiny garden he has carved out of the mountainside. High above him, along a fringe of trees, he can see a few range cows, tiny figures on the skyline, but they cannot make their way into his back yard. Every day Denver & Rio Grande trains roll over the tracks on the other side of the Arkansas, but no passenger ever drops off. In summer, an occasional hardy fisherman may come teetering across the bridge, but he only stays for a short time. When winter comes the caretaker is isolated except for the slim strand of wire that links him with the central telephone office in town. Then it is when ice and snow clog the intake and he works long hours in bitter weather to keep water flowing into the pipe.

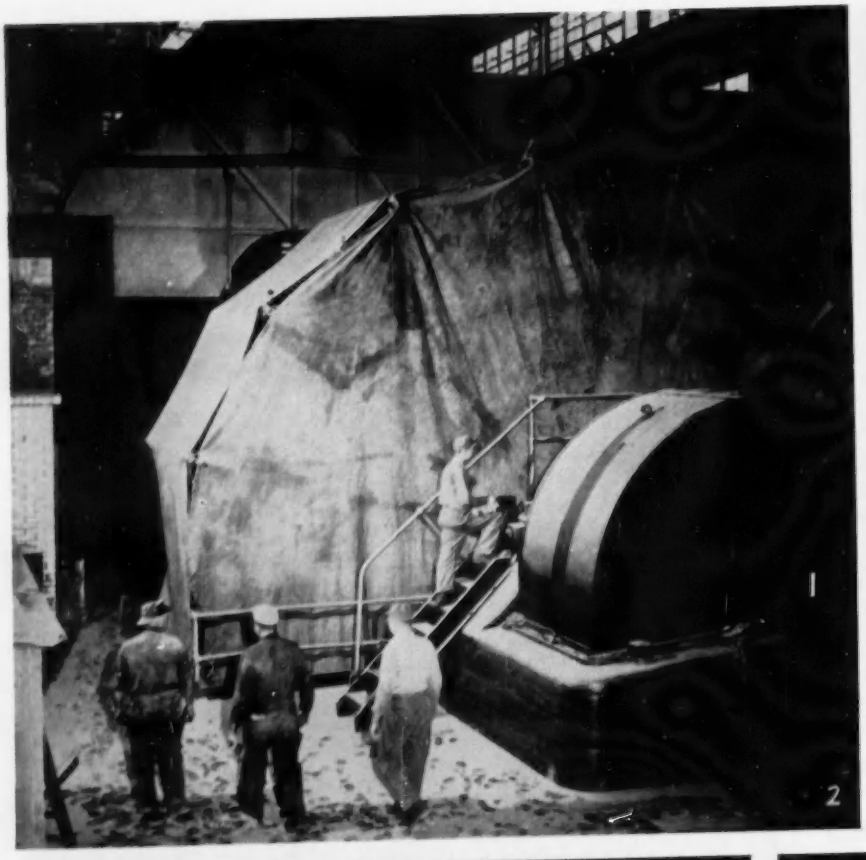
On September 1, 1955, Si Boyd, who had been stationed at the intake for a number of years, retired to his ranch in Copper Gulch. Si owned a mine out there and had made a deal that put him on Easy Street. But he had a moving job on his hands. He owned three cows: the mama cow that had come over the bridge when she was a heifer, and the daughter and the 2-year-old calf that had been born on the wrong side of the river. No 4-footed critter could ever make its way over the mountain to get out of there, so it was a case of either crossing the narrow swaying structure or staying with the new man. The old cow went over with a little urging. But Cherry, and little Bonny balked. Spraddle legged and with head down they were shoved on and, with many a snort, pushed and pulled across. After that they climbed the twisting path to the landing place 50 feet above and were loaded into a truck.

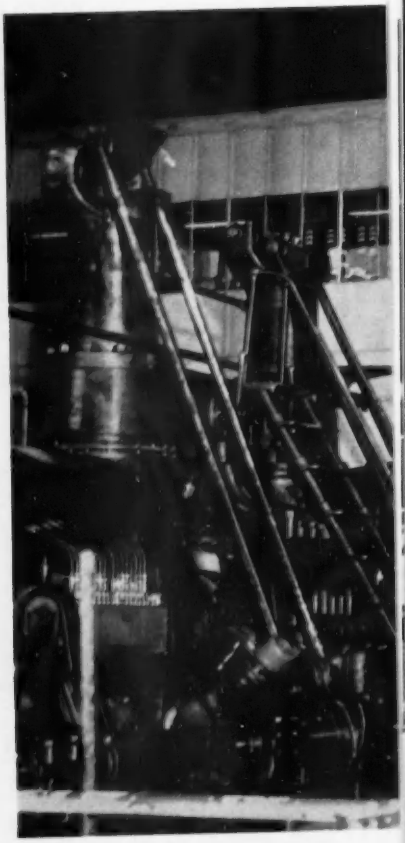
The Canon City Water Works is in good financial condition. As carried on the municipality's books, the plant is valued at $909,000. Outstanding bonded indebtedness on December 31, 1954, was $257,500. In 1949 bonds were issued for $330,000 to be spent on repairs and the building of additional facilities, including the installation of 3381 feet of new wood-stave pipe. Its cost, laid, was $36,460.22, or $10.783 per foot. The 1954 report also shows that the department operated in the black. Receipts for that year came to $96,752.80 and disbursements to $92,383.13, leaving a profit of $4,379.67. At that time it paid out in interest and to retire bonds the sum of $44,070.52.

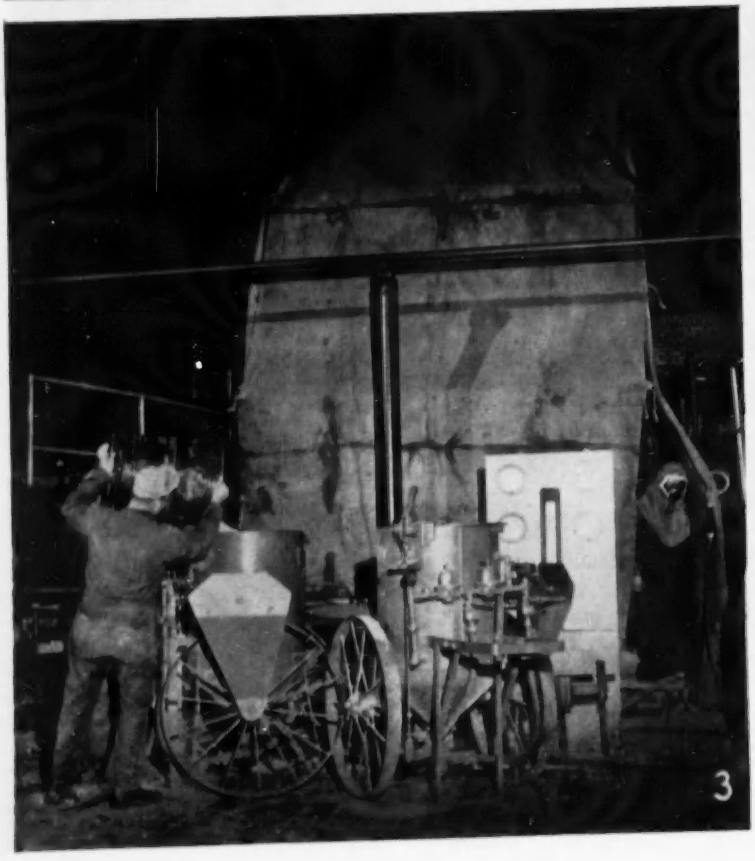


**MOVING DAY**

When a caretaker gives up his job both he and his replacement must move all their effects across the narrow foot bridge, and that poses problems. The cow shown in the top picture was born on the far side and was a bit obstinate about leaving. In the center view two laundry tubs belonging to a departing tenant are being carried up the switchback to the beginning of the road. The intake of the wood-stave conduit is in the left-background in the bottom picture. The line itself runs underground at the left.







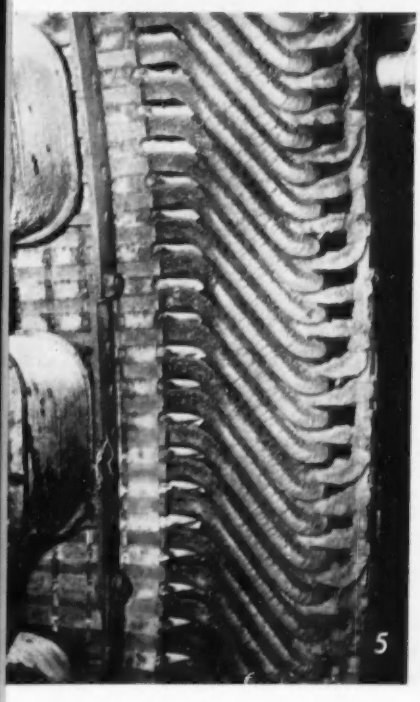
# GROUND CORNCOBS ROUT GRIME

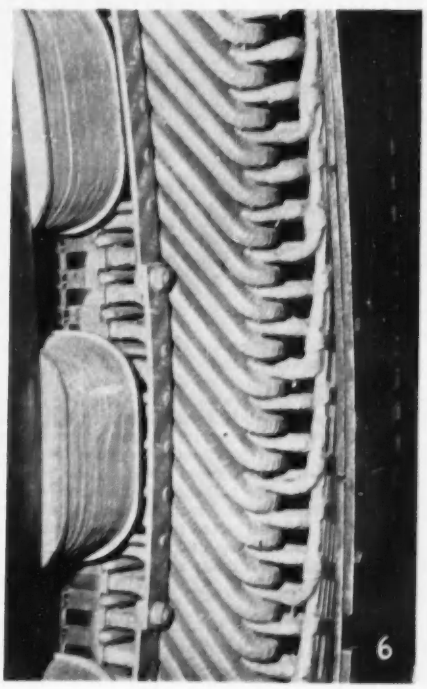
COMPRESSED air and corncob grit are saving a large steel mill 60 percent of the labor required previously to clean large electric motors and generating equipment. Five men formerly worked a total of 500 hours with hand scrapers, rags and solvents to remove accumulations of grease, dust and dirt. Seven now do the same job in 200 hours with two portable blast-cleaning units made by the Pangborn Corporation, of Hagerstown, Md.

A typical machine serviced is the 6600-volt, 3500-kw, 25-cycle gas engine-driven generator shown here (No. 1). The first step involves shifting the stator and rotor far enough apart to expose the areas of each that are to be cleaned. Then a canvas "tent" (2), consisting of two 28-foot-diameter side pieces and of one 9-foot connecting strip, is erected over the entire unit to confine the grit.

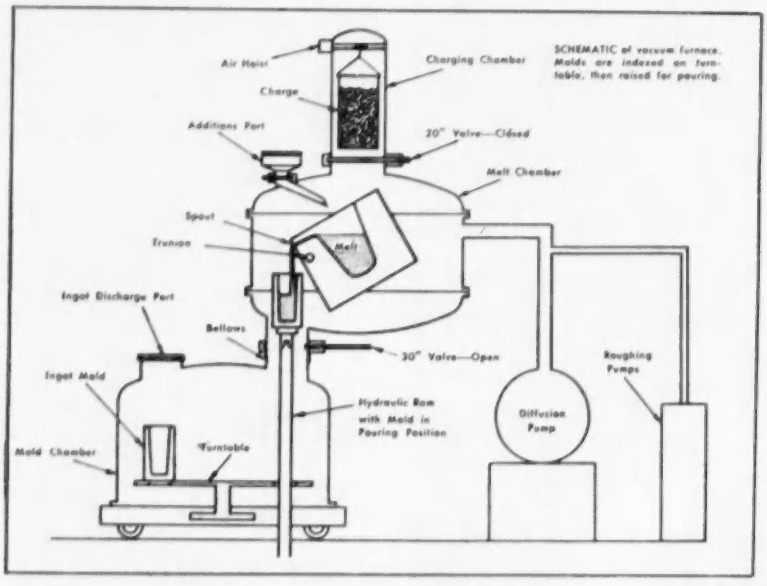
The blast-cleaning machines are filled with 20-mesh corncob grit (3) and supplied with compressed air at 90-100 psi pressure from the plant distribution system. While working on relatively soft parts such as coils and windings (4) the pressure is reduced to 20-25 psi; when blasting surfaces and other hard metal it is maintained at 55-60 psi. The grit is recovered, screened and reused. After blasting is completed the generator is blown clean with air alone at 20-25 psi. Pictures 5 and 6 are before and after views.

The canvas tent was developed on the job, as were special nozzles to insure thorough cleaning between windings and through air ducts.





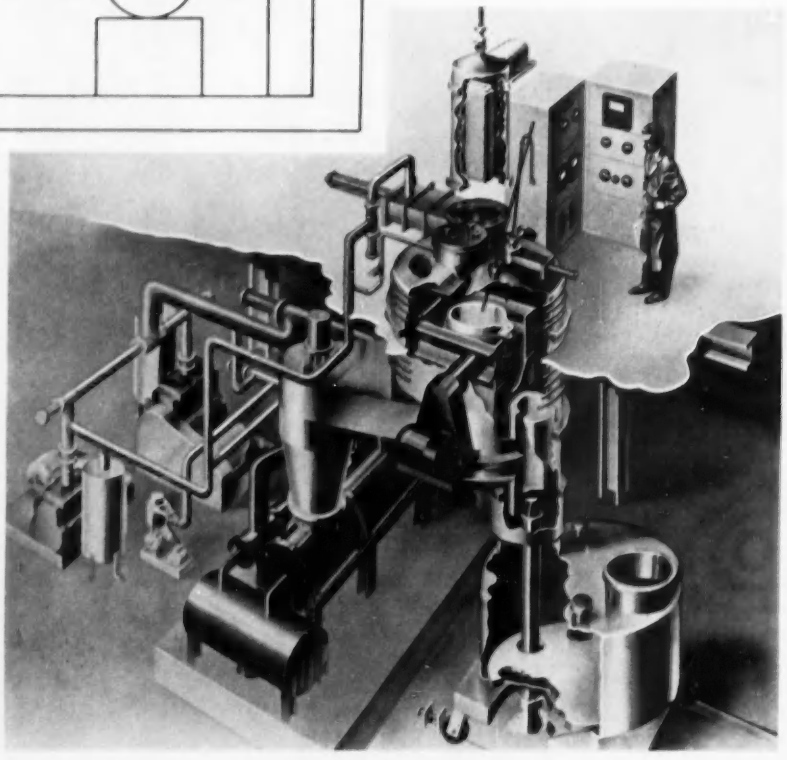
# Better Metals from Vacuum Metallurgy




SCHEMATIC of vacuum furnace. Molds are indexed on turntable, then raised for pouring.

**It Has Improved Properties Of Old Metals and Given Us Some New Ones**

R. J. NEMMERS



**PRODUCES SPECIAL ALLOYS**

An artist's conception of a 1000-pound vacuum melting furnace in the Carboloy Department of General Electric Company at Detroit, Mich. Built by Consolidated Vacuum Corporation, of Rochester, N.Y., it operates semicontinuously and turns out about 60 tons of specialized alloys per month. The control panel and charging unit (upper-right) are located on the mezzanine floor, the melting tank is in the center, a 3-stage vacuum pump and components are at the lower-center and left, and the discharge chamber is at the lower-right. The diagram shows how several molds are filled without breaking the vacuum. The molds are carried on a turntable within the bell-shaped chamber, and each is successively raised into pouring position by the hydraulic ram. The entire chamber can be disconnected from the furnace and rolled to a cooling zone while another one is positioned and connected. All moves of the mold chamber and all recharging operations can be accomplished without affecting the vacuum in the furnace proper.

OUT of the nothingness of high vacuums come metals with physical characteristics that, until about five years ago, were undreamed of outside of the laboratory. Many of them are the same chemically speaking as the old standby materials with which we are familiar, yet they are so much stronger that they deserve to be called new. Some are alloys that were hitherto impossible to formulate, while others are pure elemental metals not otherwise obtainable. Right now they go almost exclusively into military products, but in coming months they have a good chance of finding their way into consumer items such as automobiles, outboard motors and the electrical circuits of radio and television sets. And of course many will have important uses in machines destined for industry.

The big difference between the metals produced by conventional methods and those made in a vacuum is that the latter are free from much of the contamination which causes weaknesses. Metallurgists have known for some time that the production of better metals depends just as much or more on the removal of undesirable elements as it does on the addition of alloying agents. But getting rid of the unwanted substances is easier said than done. Most of them are combinations of oxygen, nitrogen or hydrogen (oxides, nitrides or hydrides) with the base metal or metals and are formed when melting takes place in the presence of air. Others are dissolved gases (in solution only during the molten stage) that form blowholes and pockets when the metal solidifies. In either case, relatively small quantities of contaminants (less than 1/10 of 1 percent) are enough to cause trouble.

Melting a pure metal or compounding an alloy in a vacuum results in two things. First of all, it eliminates combinations of metals and gases and, second, the absence of atmospheric pres-

sure on the surface of the melt enables contained or dissolved gases to boil off. It is even possible by close control of temperature to remove some solid contaminants provided their vaporization points are lower than that of the base metal itself. By using a vacuum furnace with several compartments, the temperatures of which can be individually regulated, experimenters have been able to vaporize brass and to condense its component elements in pure form, each in a separate compartment.

Prior to the development of vacuum melting techniques progress had been made towards getting rid of the contaminants. The methods usually employed in the case of most of the metals manufactured today involve the addition of other impurities or fluxes whose job it is to react chemically with those already present so as to produce a slag that can be removed mechanically, or to "tie them up" in less objectionable forms to be left in the finished ingot or casting. Those practices left much to be desired, however, because metallurgists knew from theoretical experience that it should be possible to make phenomenal gains. Even if perfection could not be attained, they at least hoped to reach a point at which the gains resulting from contamination removal would be so small as to be negligible.

The next step to be taken in order to get metals of great purity was to control the atmosphere in which they are melted. It was reasoned that the best way to eliminate oxides and hydrides would be to find a substitute for the oxygen and hydrogen that were necessary to carry out the reaction. At present this is done by using an inert gas such as argon or helium instead of normal air. Some other work is done along this line for specialty steels of the carburized and nitrided types and also for welding certain alloys. Results of the method met and even exceeded expectations but still didn't satisfy design engineers who needed even stronger materials for some of their "dream" creations. One of its chief faults was that the pressure of the substitute atmosphere prevented boil off of the contained gases.

It was logical, therefore, to relieve the pressure on the melt by performing the entire operation in a vacuum. Modern metallurgists didn't have to develop any new theory to come up with vacuum melting as a means of improving the characteristics of metals. That had already been done experimentally as long ago as 1903 in German laboratories. But because of the high vacuums required and the limited output, the final products were literally worth their weight in gold. Besides, there was no demand for metals of that kind; engineers wouldn't have known how to apply them effectively if they had been available.

About 40 years later, however, when developments in a University of Chicago handball court heralded the birth of the Atomic Age, the laboratory curiosity was dusted off and put to use refining some of the materials needed for basic research in the new field. In the course of that work a great deal of miscellaneous data about vacuum melting was obtained, and engineers began to realize that the process could be a valuable means of producing materials that would make possible some of the startling ideas on their drawing boards. Yet as late as 1948 the average batch capacity of vacuum furnaces was only one pound. By 1950 it had climbed to 10 pounds, by 1952 to 100 pounds and by the middle of 1955 to 1000 pounds. Now furnaces are being sold that can turn out more than a ton at a time, and in the course of this year it is almost certain that 5-ton units will be available.

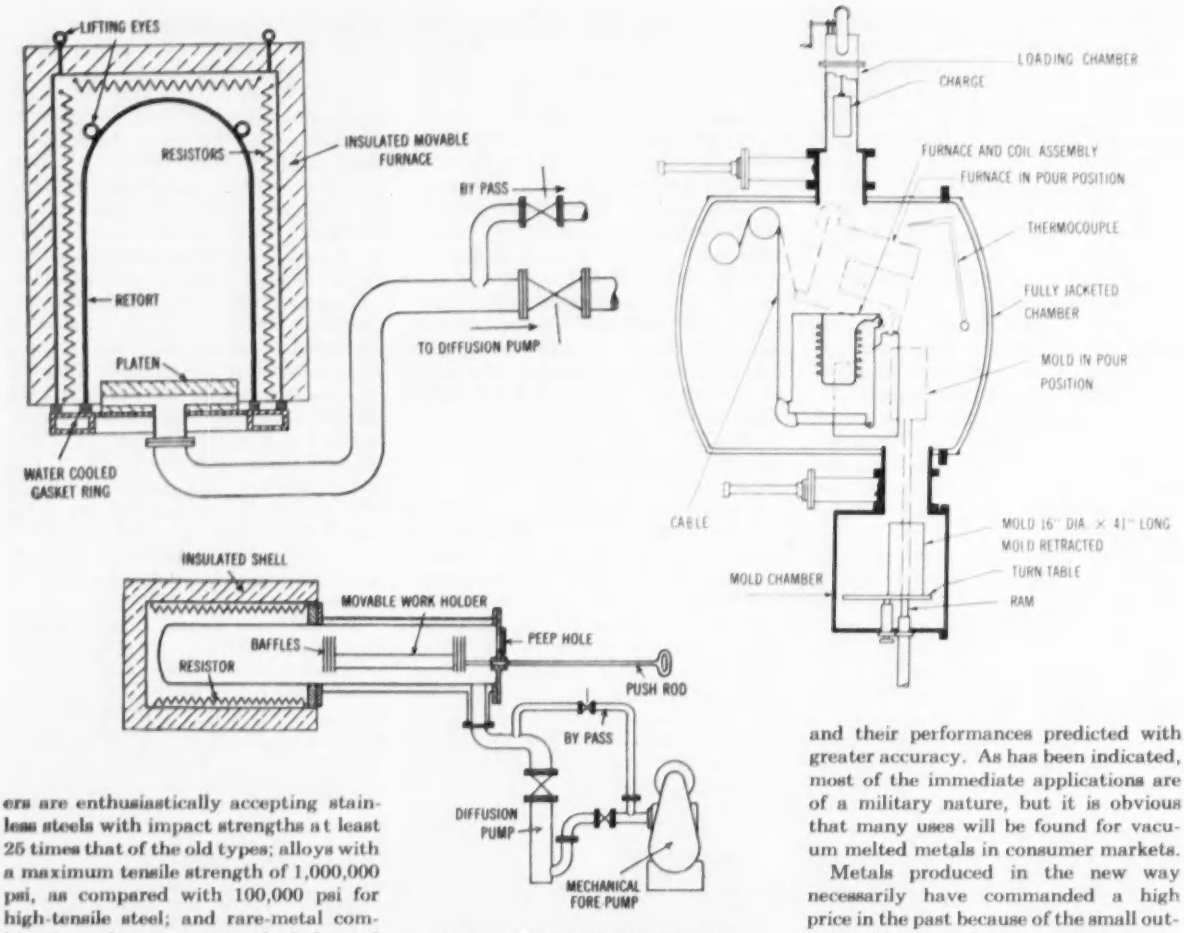
Metals from vacuum furnaces are up to 100 times cleaner than those from ordinary furnaces. Metallurgists commonly talk about levels of contamination as low as 1 part per 1,000,000 and have obtained germanium for transistors with only 1 part of contamination per 10,000,000 parts of base metal. Design-

**OBSERVING PROGRESS**

Despite recent advances in automatic control of vacuum melting processes, visual observation still produces the best results. The operator above is watching an experimental 200-pound melt through a sight glass while he turns a remote-control wheel to pour it. The temperature of the melt can be determined by an optical pyrometer. Inspection of melts is easier in vacuum-type furnaces than open-to-air units because of the absence of obscuring gases and the intense heat radiation. The furnace illustrated is a Stokes unit installed in the research laboratory of Thompson Products, Inc., in Cleveland, Ohio.

**FOR SMALL REQUIREMENTS**

Many companies that will need only moderate quantities of the special alloys obtainable by vacuum melting processes will be able to use small equipment such as this 50-pound melting and casting furnace (below) manufactured by the F.J. Stokes Machine Company, of Philadelphia, Pa. On the other hand, really big producers of the supermetals may soon be able to get furnaces with batch capacities of more than 5 tons.




**DIAGRAMS OF RESISTANCE-HEATED FURNACES**

The simplest unit, at the upper-left, has a removable heat source surrounding a bell jar-type retort. The one at the lower-left has a movable work holder or boat that travels between the heating and cooling zones. On the right is a semicontinuous furnace with loading and unloading chambers that enable several melts to be processed without admitting air to the retort. A hydraulic ram moves the mold to and from the pouring position. After the casting has solidified, a valve is turned to seal off the unloading chamber so the mold can be removed and replaced with an empty one for the next pour. Similar arrangements are made for recharging. Furnaces of this type, regardless of how they are heated, are generally preferred for production work because they require less power per melt for evacuation and thus function at lower over-all operating costs.

ers are enthusiastically accepting stainless steels with impact strengths at least 25 times that of the old types; alloys with a maximum tensile strength of 1,000,000 psi, as compared with 100,000 psi for high-tensile steel; and rare-metal combinations that are extremely light and yet far stronger than like sections of more common materials.

Castings produced in vacuums are much stronger and sounder than their counterparts poured in air. Surface characteristics of both castings and mill forms rolled from ingots are greatly improved by the process because no foreign matter is included to cause flaws. And the performances of some of the new alloys at extremely high temperatures are already making it possible to build faster and longer-lived jet aircraft as well as more accurate guided missiles. Ball bearings from vacuum-melted metals have displayed amazingly high resistance to wear, and more bearing components find their way past plant inspections. One manufacturer has been able to cut rejections from more than one-third of the total output to about one-twentieth. Furthermore, metals take a better polish for superprecision bearings.

Emission characteristics of copper-base electronic cathodes are considerably improved by vacuum processing, and by subjecting vacuum-tube materials to the same treatment the finished product can be degassed more rapidly. Copper poured at low pressures has an electrical conductivity that closely approaches the theoretically predicted perfect value; springs are superior both as to resilience and service life; and wire can be drawn to much finer dimensions because it is more ductile and also because there are no microscopic flaws in the surface of the metal or inclusions to cause breakage. Thermocouple alloys can be compounded more precisely in vacuums and their performances predicted with greater accuracy. As has been indicated, most of the immediate applications are of a military nature, but it is obvious that many uses will be found for vacuum melted metals in consumer markets.

Metals produced in the new way necessarily have commanded a high price in the past because of the small output and because the money spent on development had to be tacked on to the cost. At one time the supermetals sold for dollars per pound instead of cents, but now the price is beginning to drop rapidly. Large-scale manufacturers expect that each type may cost from one and one-half to two times as much as its counterpart melted in open furnaces and crucibles. There are many factors, however, that justify the added outlay and may even make the metals cheaper in the long run. The first, of course, is strength: if a pound of one of the new alloys can be made to serve in place of 1½ pounds of another metal the initial cost may not be too much higher and operating costs might be considerably lower. Another saving is attributed to the fact that vacuum metals are so pure that little is wasted.

As an example, let us point out the ball-bearing manufacturer referred to previously. Although the raw materials cost the company more, the sharp reduction in rejections caused the unit price of the final product to change little. This is borne out by the Carboloy Department of the General Electric Company which published charts relating to the forgeability of its M 252 alloy. About 500 to 550 pounds of bar stock can be

made from a 1000-pound ingot of air-melted metal, the remainder being scrap. A 1000-pound ingot of vacuum-processed M 252 yields 700 pounds of bar stock, leaving 300 pounds of scrap.

Moreover, vacuum melting permits virtually complete scrap absorption—in other words, 1000 pounds of scrap can be remelted to produce a 1000-pound ingot. That is not the case with the comparative M 252 alloy, which calls for the use of 700 pounds of new metal and only 300 pounds of scrap in an ingot of the same size. The two advantages cited can give the new metals a big price differential while still holding the line on unit cost. It is entirely feasible that some premium-quality goods can be made at a lower outlay with vacuum metals than with the conventional materials.

Vacuum furnaces can be classified by the way in which heating is done; that is, by electrical resistance, arc or induction. The resistance furnace consists essentially of a vacuum chamber or retort, a means of drawing the vacuum, a crucible for the metal to be fused and a set of resistance elements generally on the outside of the retort. Variations have to do with size and arrangement of the parts. One type has movable retorts and stationary resistance or heating units; another is just the reverse—has a stationary retort around which the resistance banks move.

An induction furnace is made up of the same components as the resistance type except that an induction coil is substituted for the resistance elements. The inductor is usually placed inside the vacuum chamber, however, and heats only the crucible and its charge. Differences in basic construction permit the crucible to be tilted at the end of a melt to pour the metal into a mold, or a plug can be removed from the bottom so the molten metal will flow into the mold. Provisions can be made for adding alloying materials and stirring the melt without breaking the vacuum.

Another induction furnace now being closely studied is designed to produce metals containing almost no impurities. Normally, a certain amount of crucible material always goes into solution and contaminates the melt. That cannot happen in the new furnace because it dispenses with the crucible. Instead, the metal is suspended in space in an electromagnetic field and, if necessary, can be stirred simply by rotating the field. If it is allowed to cool while still in suspension, the product will come from the furnace in a nearly perfect solid sphere. The possibilities of this innovation are as intriguing as the process itself.

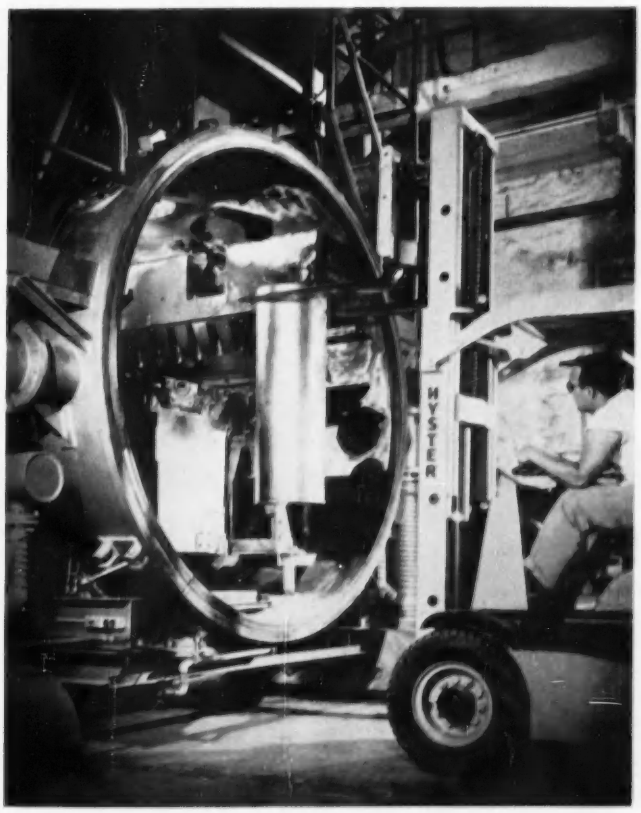
The vacuum-arc furnace is used for metals with very high melting points. There are two fundamental types; one with a permanent electrode of graphite, tungsten, etc., and the other with a consumable electrode of the same material as the charge to be fused. The latter method is preferred for most supermetals because there is no chance of contamination from an electrode of some other substance.

High vacuums are required for the metal-melting process. They are measured in terms of microns each of which is equivalent to a column of mercury one millionth of a meter or one thousandth of a millimeter in height. Absolute pressures applied range from 0.001 micron to 100 microns and, depending on the value, are obtained by several different methods or combinations of methods.

For large installations a steam-jet ejector of up to three or even five stages can be used as a means of "hogging," that is, rapidly reducing pressure to moderate levels (approximately 10,000 microns or 10 millimeters of mercury). Or reciprocating compressors (vacuum pumps) can be utilized in the case of a slightly higher range. At about the lowest level of efficient operation positive-displacement rotary vacuum pumps take over to reduce the pressure to about 10 microns. If still lower pressures are required, then a diffusion pump is added to the vacuum equipment. This type of pump works by vaporizing a normally fluid substance such as mercury or oil

**THE CAN GOES IN TOO**

A 2-ton fork-lift truck hoisting a nickel can containing the preweighed and analyzed main charge for a 1000-pound melt—roughly 70 percent of the charge—into the chamber of one of the vacuum furnaces at the plant of the Utica Drop Forge & Tool Corporation, Utica, N.Y. Both can and contents are lowered into the crucible, the can becoming one of the alloying ingredients. Other alloying additives, also preweighed and contained in six tilting hoppers on the far wall of the chamber, will later be placed in the crucible without breaking the vacuum. Below is a close view of a 500-pound ingot of "Wespaloy," a jet engine-blade material cast at Utica. At the left end is the "hot top," with fragments of asbestos still clinging to it. Charge stock for these ingots can be primarily scrap from other high-alloy sources, thus conserving scarce strategic alloying materials. Government procurement agencies are consequently interested in vacuum-furnace processing.



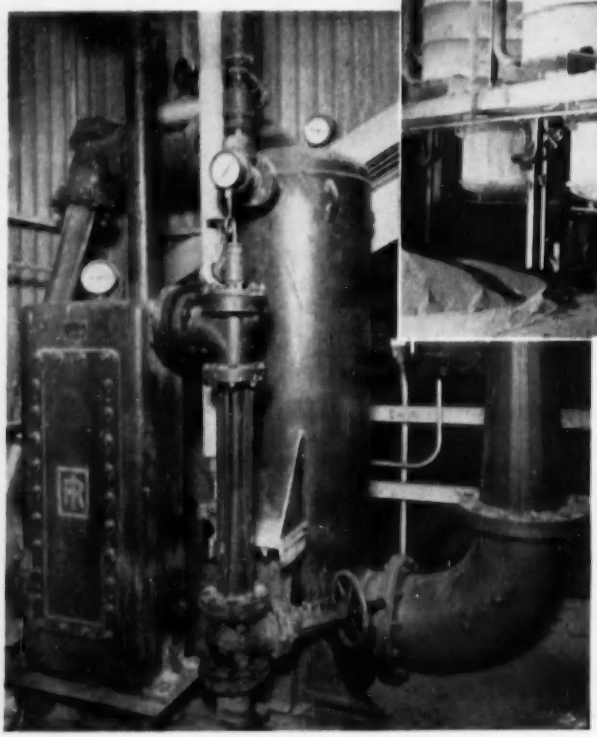
**WORKING FROM OUTSIDE**

It is often necessary to reach the melt with stirring rods, thermocouples or bridge breakers. The picture above shows "mechanical hands" working through special seals. The operator is using a bridge breaker on a charge being melted in Carboloy's 1000-pound furnace. Despite the intense glow that lights up the man so vividly little heat reaches him across the high vacuum-insulated space between him and the molten metal. The temperature in the crucible ranges from 2800 to 3200°F.

and then condensing it in a special chamber. As the vapor returns to the fluid state in the so-called evacuation chamber it entrains molecules of air. The condensate flows back to the boiler or vaporizer where the air is trapped and ejected and the fluid recycled.

Annual industrial production of vacuum melted metals in 1954 was probably under one million pounds; furnaces constructed during 1955 may have boosted the output to 10 million pounds; and forecasts for this year indicate a capacity of 20 million pounds on the conservative side and more than 200,000 tons on the optimistic side. Exact figures cannot be given because data on top-secret government projects are not available. Then, too, many manufacturers aren't telling all about their plants and plans. It has been revealed that the country's largest vacuum furnace—a unit with a batch capacity of 2200 pounds—was tapped on December 8, 1955, by Vacuum Metals Corporation at its Syracuse, N.Y., plant.

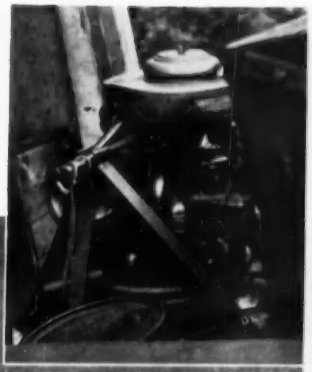
No one expects vacuum melting to replace the older methods of metal and alloy production, or even seriously to challenge the predominance of open-hearth steel. Metals of such high purity and strength aren't needed for most applications. Big consumers like the automotive and appliance industries have steels that outlast the lives of the parts made from them. But there is no doubt that vacuum-melted metals are the thing for special uses and that the market will grow as new products designed to take advantage of their properties come from the drawing board.

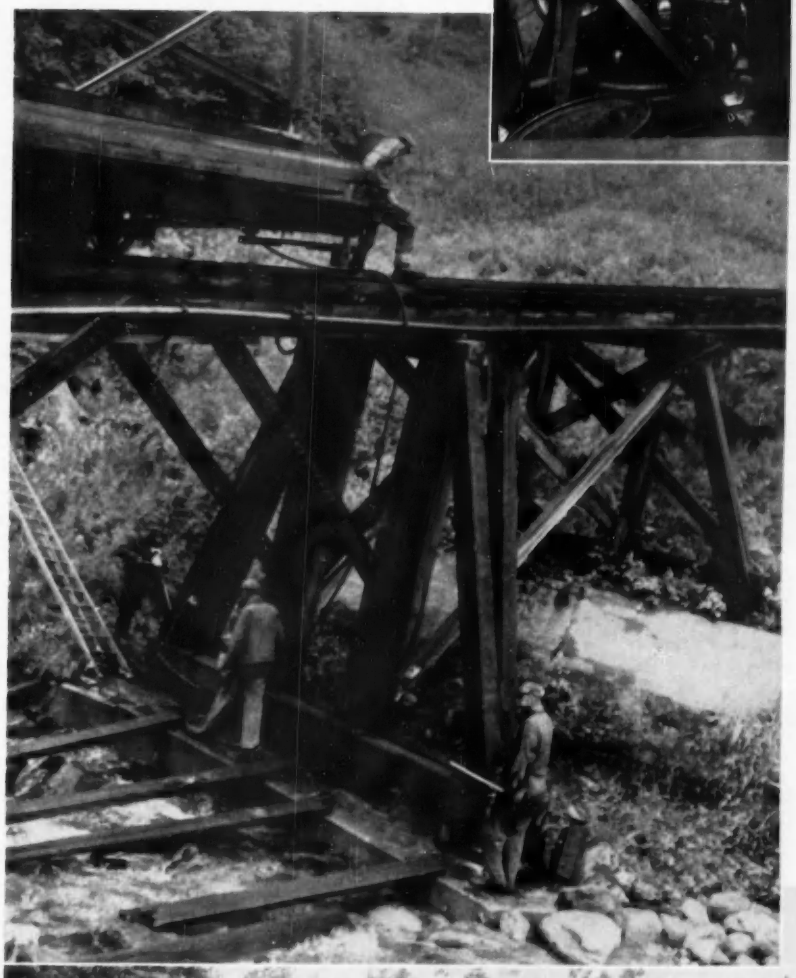


**REFINING FERRO-CHROME**

In the furnaces shown above, Pacific Northwest Alloys Company refines high-carbon ferro-chrome into a low-carbon product that enters into stainless steel and also has other uses. After the furnaces are loaded with a prepared mix, the air is evacuated and heat is applied electrically while vacuum is maintained. Undesirable products are removed as gases. The several vacuum-producing systems available can reduce the pressure to any desired point within the range from 50 millimeters of mercury to less than one millimeter. One of the systems is the Ingersoll-Rand 3-stage ejector pictured at the left. Its three steam jets, with intercondensers, can lower the pressure from atmospheric to the 50-to-5 millimeter range.

# COG RAILWAY VALETS





THE railway that carries tourists up Mount Washington, in the Presidential Range of the White Mountains in New Hampshire, was the first cog road built. It was started in 1866 and completed in 1869. As it is unused the greater part of the year and subjected each winter to the rigors of heavy snowfall and extremely low temperatures, it is vital that it be given proper maintenance. These pictures show a work train halted for the purpose of repairing a trestle near the base of the peak, which is the highest (6288 feet) in New England.

To operate the pneumatic tools that are used on track and bridge maintenance, the work car carries an Ingersoll-Rand Spot-Air compressor that was developed primarily to "spot-tamp" ballast under ties. It is a compact unit in which the three cylinders of its gasoline-engine driver and the three compression cylinders are arranged radially around a vertical crankshaft. The machine weighs only 265 pounds and can be readily moved by two men. It delivers 36 cfm of air at 80 psi pressure.

To prevent the compressor from shifting and to hold it level so as to insure proper functioning of its engine while the car floor is tilted on steep grades the crew mounted it on trunnions, as pictured at the top. It is free to swing, and thus stays upright at all times. The view in the center shows the compressor delivering air through a hose connection to an I-R Multi-Vane drill being used to bore boltholes in a trestle timber. Tools and materials are lowered by the swing boom mounted on the lead car, as seen at the bottom.

# Steel Mill Housekeeping Aid

## Pickard-Warren Conveyor Saves Time and Money in Cleaning Open-hearth-furnace Checkerwork

**SHOP VIEW OF CONVEYOR**

The aluminum beam on which the conveyor runs is supported at one end by framework and at the other is suspended from a chain hoist. The bucket is of the central-opening type. It unlatches when tilted while held in the grip of the arms shown hanging down near the center of the beam. The operator has a hand on the throttle of the air hoist.

THE disagreeable but necessary job of cleaning flue dust from the checkerwork of open-hearth furnaces in steel mills has been greatly improved by a semiautomatic combination lifting and conveying mechanism called the Pickard-Warren Conveyor. It includes several unusual features, among them a bucket that empties by splitting apart. The equipment is manufactured by Mars Engineering & Fabricating Company, of Mars, Pa., near Pittsburgh.

A furnace's checkerwork is built of firebricks spaced far enough apart to leave open passageways between them. It is located adjacent to and at a lower level than the hearth and serves to conserve heat. Hot exhaust gases from the furnace flow through the intricate passageways to heat the bricks. Then the bricks, in turn, heat incoming combustion air and also gas if the latter is the fuel (tar, oil, etc., also can be used). There is checkerwork at each end of the furnace, and circulation is directed through the two areas alternately. Thus, while one is being heated, the other is giving up its stored heat. It is important that flue dust be removed regularly to improve heating efficiency and reduce fuel consumption.

The Pickard-Warren Conveyor is built about an aluminum beam on which runs a trolley carrying the bucket. The beam is supported at one end by an aluminum frame on which is mounted an Ingersoll-Rand Size BU single-drum air hoist and at the other by a chain suspended from an overhead hand-operated hoist. This arrangement permits it to be lowered readily for repairs or servicing. In operation, the free end of the beam is spotted over the opening that extends down into a pit below the checkerwork to be serviced. The bucket is suspended from the wire rope unwound from the drum of the air hoist and is lowered into this space.

At the bottom of the pit (see accompanying drawing), the bucket is detached from the cable and moved laterally in a passageway leading to the checkerwork. For this purpose portable sections of a roller conveyor can be laid down, wheels can be permanently affixed to the bottom of the bucket or the latter can ride on a vehicle of some sort. After being filled with flue dust, broken bricks, etc.,

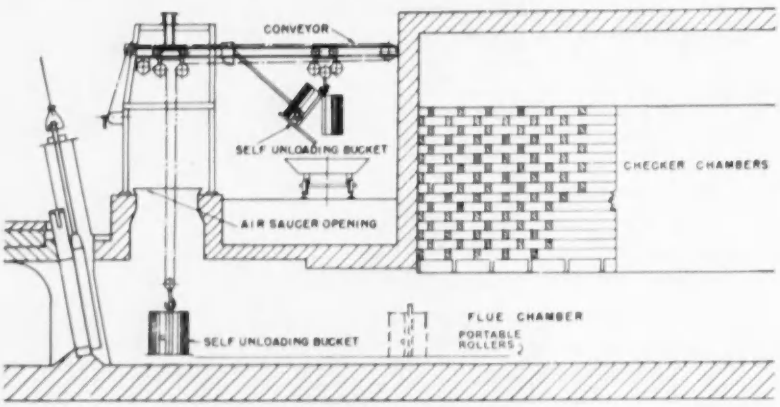



**DIAGRAM OF FURNACE CLEANING**

The bucket at the lower-left will be unhooked, moved into the flue chamber, filled, brought back and lifted out. When it reaches the conveyor it is engaged by the trolley, carried to the right and dumped by opening at the center, as shown. The latter sketch also illustrates how, during opening, the solid 1-piece bottom of the bucket remains with the half to which it is attached. When the bucket is closed, the bottom fits snugly up against the other half.

the bucket is pushed back to the opening, the cable is attached and it is hoisted to the beam end where the block and hook by which it is fastened to the cable are engaged with the trolley.

An automatic control then takes over and causes the trolley to move horizontally along the beam to the dumping station, which may be anywhere throughout its length. At the point selected, two arms hanging from the beam engage trunnions on opposite sides of the bucket. As the trolley continues to move, latches on the sides disengage and the bucket opens vertically at the center, spilling its contents. The weight of the material carried has nothing to do with this action, which is the same regardless of the load. Speed of opening may be controlled to empty loose material gradually onto a conveyor belt or to drop it quickly into a truck or car.

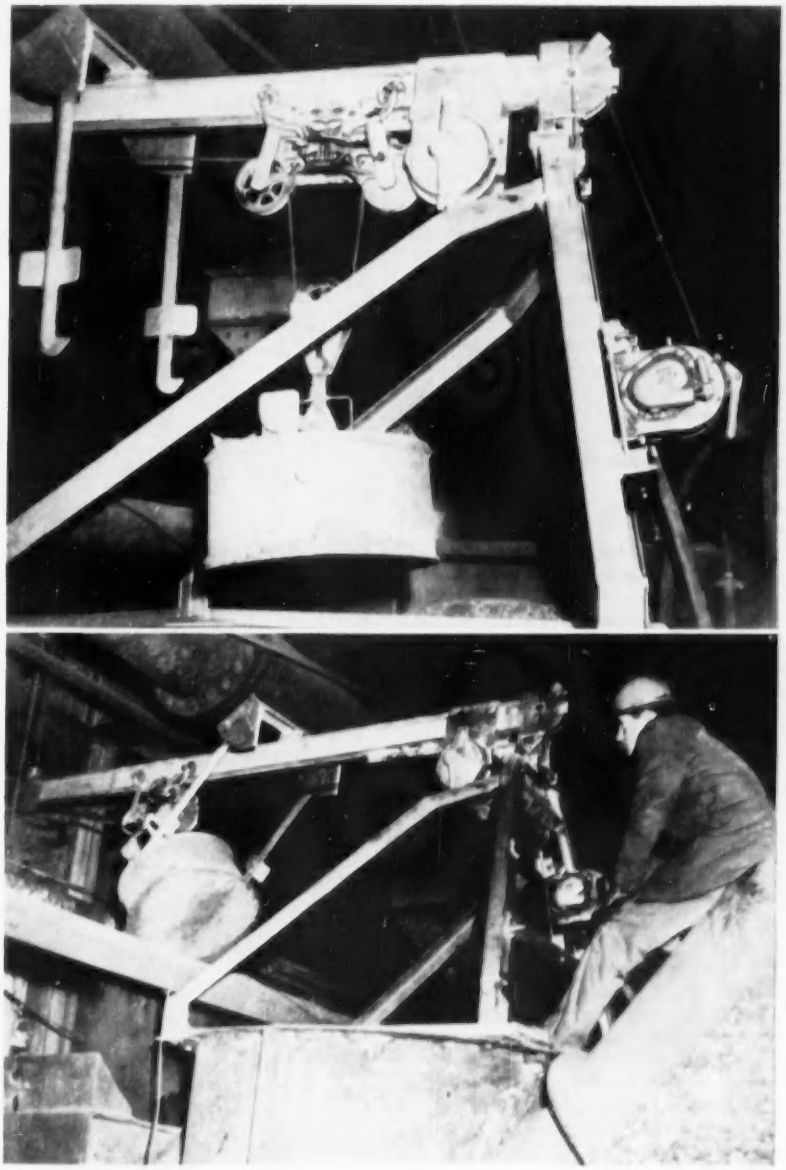
From the time the operator pulls a lever to start hoisting the bucket until the load has been dumped he has nothing to do. Even if he should at that stage forget to close the air-hoist throttle no harm will be done. The motor will merely stall. To return the bucket for another trip he reverses the throttle, but the hoist does not supply the power for the return movement. Instead, the trolley is pulled back by two spring-loaded Reelites working in tandem. As the trolley travels in the opposite direction and the arms relinquish their hold the bucket is automatically closed and latched. When it reaches the far end of the beam a knocker stops horizontal motion, releases the block from the trolley and permits the bucket to descend for another load.

The air hoist has a lifting capacity of 750 pounds at a rope speed of 40 feet per minute. To raise a load 20 feet, carry it laterally 10 feet, dump it and deliver the bucket below takes from 45 to 90 seconds. Buckets may be had with a capacity of from 1½ to 5 cubic feet to meet different conditions.

With the aid of this new equipment furnaces can, it is claimed, be cleaned in about half the time previously required and with the same labor force, or in the same interval with half the men. The time a furnace is out of service may be reduced by as much as two turns or shifts. Installation is simple and no tools are needed. The rigs are light and readily movable. More recently the conveyor was used to lift earth that was being dug from a deep trench and dump it into trucks for disposal. Pictures of that application will be shown in a later issue.

In addition to its principal function, as described, other uses have been found for the conveyor. One has been at work for nearly four years removing a combination of grease and steel scale from a pit beneath a rolling mill. The action of the bucket—its opening by being pulled apart—seems to be just what is needed to dump this hard-to-release material. The bottom of the bucket is literally yanked out from under the sticky mass. In addition, it has been found that the conveyor contributes to the safety of the cleaning operation.

The inventors of the conveyor—E. Pickard and R. Warren—are employed by the United States Steel Corporation, which has a number of the units in service. They were encouraged to design it by W. W. Scheer, division superintendent of maintenance at the Homestead Works. He suggested that they model it after one of the old-time hay loaders that were once widely used on farms, but they struck a snag when they tried to locate one. After a great deal of searching, they found one in a dark, dusty corner of a Pittsburgh warehouse owned by the Scott Seed Company. It was manufactured by the F.E. Meyers Company, of Ashland, Ohio. Although the Pickard-Warren conveyor resembles the hay loader in principle, it embodies so many modern features that patents were issued on six of them.



**DUMPING ACTION**

The picture at the top shows a bucket being hoisted and about to engage the trolley running on the overhead beam. At the right is the air hoist that operates it. The arms that will help to empty the bucket are hanging down at the left. In the other picture the bucket, gripped by the arms, is seen tilted for dumping. It will open when it is tilted farther. The operator is ready to reverse the rotation of the hoist's drum as soon as the bucket has been emptied.

# ROOTS OF A SKYSCRAPER

BEN A. GREEN

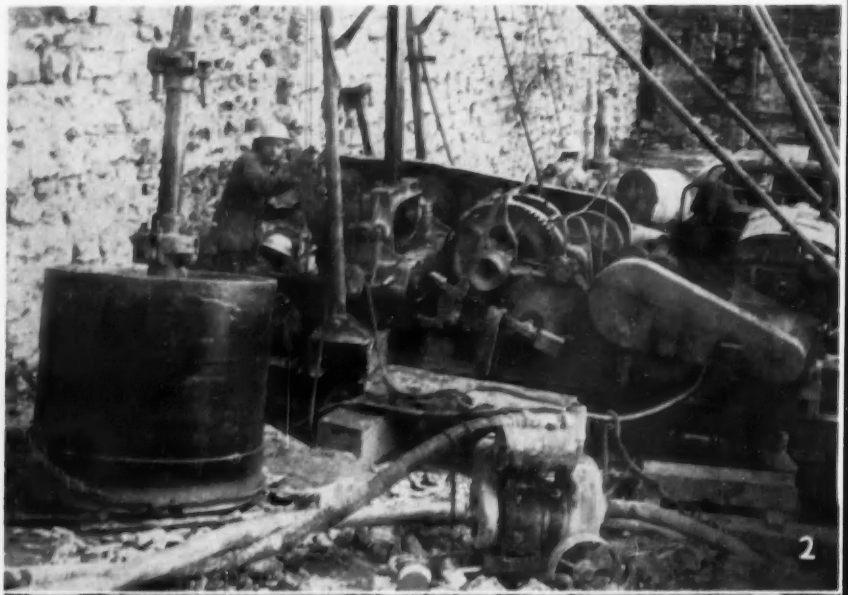
BUILDINGS, like things that grow, have to be properly planted, and in this era of skyscrapers foundation work has become a rather exact science. In general, the taller the structure, the deeper the roots, but the character of the subsurface at the site determines the engineering treatment to be given it. A firm footing is, of course, essential.

In Nashville, Tenn., steelwork has been erected for the tallest commercial structure in the southeastern states—the 15,000-ton, 409-foot, 30-story Life and Casualty Tower. It occupies a corner property roughly 130 feet square, with abutting buildings on two sides of it. Test drilling to a depth of 50 feet indicated that the limestone formation underneath a shallow mantle of earth was unfaulted. The excavation was carried down to a uniform depth of 30 feet, which called for the removal of 3000 cubic yards of earth and 8000 of rock. Because of the built-up area and heavy traffic, blasts required to shatter the rock were shielded with old rubber tires and steel mats. About 3 tons of dynamite was detonated.

In order to tie the structure firmly to the rock it was decided to concrete some of the steel columns in it to a depth of 23 feet. A way was sought to sink the holes for this purpose without disrupting the limestone, and the solution was found in an Ingersoll-Rand Calyx core drill. This machine cuts a circular path in the rock with steel shot fed beneath the edge of a revolving steel cylinder.

The drill used was equipped with a 36-inch-diameter bit and had seen service on several of the large hydroelectric dams constructed by the Tennessee Valley Authority. It was desirable there to put down holes large enough to enable geologists to descend and examine the underlying rock in place. At the Nashville site the machine drilled 250 feet of 36-inch hole within a 60-day period. In addition to excavating the openings for the steel columns, it was of aid in drilling two bigger square pits at the lower extensions of elevator shafts. The work was done by Geologic Associates, Inc., a Nashville firm. The foundation contractor was McDowell & McDowell.

Life and Casualty Insurance Company of Tennessee, which is erecting the building, has its home office in Nashville. It will occupy 45 percent of the space and rent the remainder. Interior partitions will be movable and the entire structure will be air conditioned.



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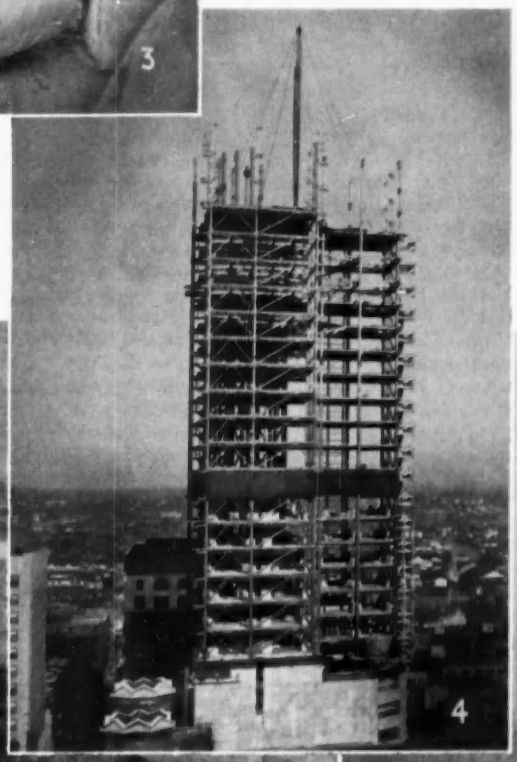
1 Looking down on the site from the twelfth floor of a building across the street. Holes drilled by the Calyx rig and cores extracted from them are visible. The drill is standing against the left wall.

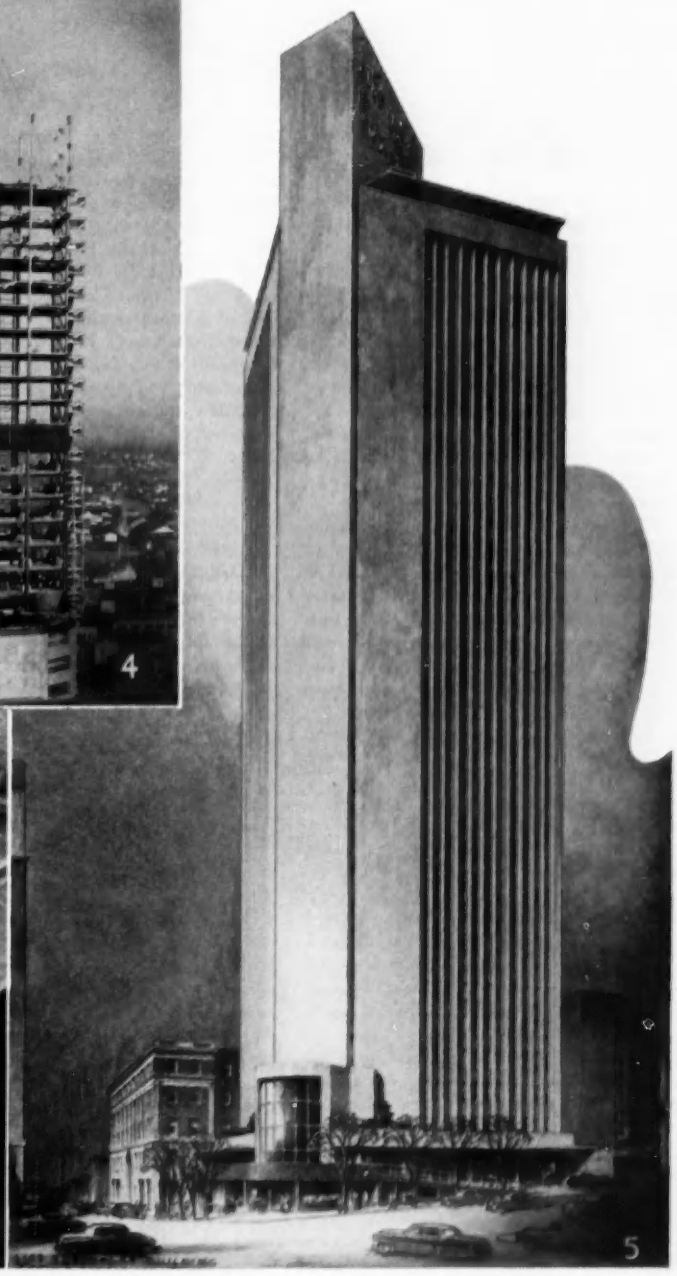
2 Close-up of the Calyx drill. At the left is a 36-inch bit with attached drill stem for rotating it. Power was supplied through gearing by a gasoline engine.

3 Operator Floyd Slagle cutting notches in the lower edge of a bit with a torch. One of the rock cores is in the foreground. Note the hole in the center where a pin was driven to lift it out of the hole.

4 The Life and Casualty Building as it appeared recently with a few more floors of steel to be erected. Work of facing the exterior with stone had been started.

5 Artist's conception of the building as it will look when completed next year. The structure is set back from the street, and trees will be planted in pits along two sides of it.





# Editorials

## THE SCIENTIFIC APPROACH

THE Ohio Department of Highways is making a sensible approach to the pressing problem of highway accidents. And, like most sensible efforts, it is paying off. The department has substantially reduced the accident rate by altering the physical conditions at some locations where mishaps have repeatedly occured. Over a year's time the composite safety record at these points has been improved by 65 percent.

The first step in the campaign was to select the spots in the state road system with the worst accident records. Then an effort was made to pinpoint their hazardous features. Why, the investigators asked, was one intersection the scene of more accidents than another that looked much the same? To find out, they conducted detailed traffic and engineering studies.

Changes were made and their effects observed. The investigations continued and often revealed additional helpful information that led to further modifications and improvements. "Our entire effort," states Engineer H.G. Eckhardt, "has been towards the reduction of accidents by the scientific approach. In evaluating our methods, no one factor can be considered all-important. Speed-zone correction, curvature delineation and the elimination of non-essential, confusing signs and markers are only a few of the treatments we may prescribe."

Typical of the procedure followed was that at a bad spot on Route 25 north of Cincinnati in Butler County. There the 2-lane highway descends a one-quarter mile 5-percent grade, runs under a railroad overpass, then makes an abrupt turn and climbs again. Twenty accidents had occurred there within one year. Twenty-mile-per-hour-speed-limit signs had been posted at intervals along both approaches but were often unheeded. Traveling at high speed, a motorist entering a downgrade stretch might fail to slow down appreciably. The overpass prevented him from seeing the turn soon enough, and he was unable to stay in his own lane when he came upon it abruptly. He might either collide with an oncoming vehicle or crash through the guardrail. During rainy weather, cars speeding both ways were occasionally forced off the road because of slippery pavement.

Careful study of the section and of the accidents that had happened there indicated that many corrective measures would have to be taken to improve the record. Huge 80-inch-long reflectorized arrows facing both ways were put up, but with cars going downhill in opposite directions their headlights were beamed too low to strike the signs soon enough to enable them to slow down, so direct illumination and flashing signals were added.

The ridiculously low-speed-limit signs were replaced by 20-MPH warning signs. All unnecessary signs, including route markers, were removed to lessen confusion. At the approach to each curve, small reflectorized posts were placed 100 feet apart. Going into the curve the distance between them was shortened, and around the curves it was cut to only 16 feet. Experience has proved that the posts have a psychological influence in guiding drivers around the turn. Finally, nonskid pavement was laid with no-passing lines painted on it, and bridge-end markers were placed on the abutments of the underpass. In the year that followed, the number of accidents fell from 20 to 5, a reduction of 75 percent.

At the 40 locations that were improved there had been 589 accidents in the year preceding the changes. During the ensuing year the total was 207—a reduction of 282. At seven points all accidents were eliminated. At seven others they were cut down by at least 90 percent, and at nine others 60 percent. Reductions ranging from 33 to 60 percent were recorded at the remainder. Surveying the results, the department is convinced that this realistic approach is the answer to a very realistic problem.

## GHOSTS FROM THE PAST

A WORD out of the past returned to the news columns recently when the Canadian press told about a campaign being waged by the Ontario authorities against high-graders. Half a century ago in the Old West, high-graders were in the news almost as much as horse thieves, to whom they bore a certain relationship. A high-grader, as any veteran mining man knows, stole rich or high-grade ore and disposed of it through illicit channels. Every early-day gold mine of consequence had its quota of these unwelcome "partners."

The high-grader was an "inside" man; he worked in a mine (or mill) and carried out his loot bit by bit. The artifices to which he resorted to escape detection were legion. Shirts of double thickness with pockets between layers, narrow sacks that hung down a trouser leg, hollow-heeled boots, lunch buckets with false bottoms and hats with false crowns were some of the devices.

Dishonest assayer accomplices disposed of the spoils. Half a dozen assayers could have handled the legitimate business of Cripple Creek, Colo., or Goldfield, Nev., in their heydays, but the former had around 50 in 1900 and the latter 37 in 1906. Mine owners couldn't stop the thievery because the courts rarely convicted a high-grader. Too many of their own kind or their relatives or sympathizers got on the juries. Even some merchants didn't like to see free-spending customers with ready money removed from the scene. Public sentiment was often with the scofflaw and against the supposedly rich and heartless operators. The mine owners had to go to extremes to protect themselves against this setup.

One night in 1902 eight assay offices in Cripple Creek were dynamited. Everybody knew why, and there were no arrests. Then the "change" system was instituted—miners had to change clothes when coming off shift. This strenuously resisted regulation contributed to causing a bloody strike that took a heavy toll of lives and property. In the end, the mine owners won by establishing a central employment bureau that screened all job applicants and rejected those of questionable character. In 1917 Colorado assayers were put under bond by state law.

High-grading also flourished in other countries. Kalgoorlie, Australia, estimated that thefts aggregated $5,000,000 in 1906. During one year the gold exported or sold to the mint in Perth exceeded the officially reported mine production by $2,000,000. Cobalt was Canada's only mining camp of importance in that period and was a silver producer, but the ore was so rich that it attracted high-graders. At one time they reportedly had their own small smelter for extracting the metal.

The current drive in Canada seems to have been kept rather quiet—and for obvious reasons. About a year ago the Ontario Provincial Police formed an "Anti-Highgrade Squad" and posted units in the gold-mining districts of Timmins, Kirkland Lake and Red Lake. To ferret out the "pushers" behind the racket some undercover men took jobs in the mines and sold gold at $5 to $10 an ounce to establish contacts that might lead them to the higher-ups.

Much of the purloined gold has been smuggled into the United States, Israel and Hong Kong. In the latter places the black-market price of gold usually exceeds the $35-per-ounce official price that has been in force in the United States and Canada since 1932. Partly as a result of "tips" from abroad, twenty convictions have been obtained since last April and $35,000 worth of stolen gold has been recovered.

## ANOTHER BIRTHDAY

THIS issue marks our sixtieth year of publication, the first issue having appeared in March 1896. As our fiscal year now conforms with the calendar year, we began compiling Volume 61 in January.

# This and That

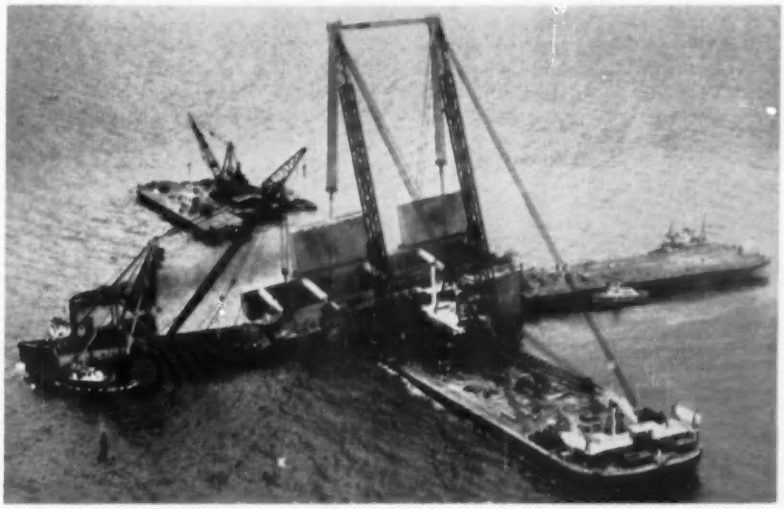
**As the Census Sees Us**

If you want to compare yourself with your fellow man, buy a copy of the Statistical Abstract of the United States compiled by the Bureau of the Census. If the price of $3.50 seems high, take note that it is 25 cents less than in any of the other 75 years it has been published. Also, someone has figured out that it offers statistics at the bargain rate of seven ten-thousandths of a cent each. Here are some samples: Aliens registered in the nation in 1954 numbered 2,365,811. Deaths from diseases affecting the heart are 90 percent greater than they were in 1900. In 1953 the average family spent $178 for medical and dental services, $175 for life insurance. Arrests of children under eighteen years totaled 149,806 in 1953, contrasted with 86,128 in 1952 and 37,259 in 1951. Movie-house box-office receipts declined 28 percent between 1948 and 1953, but sales of popcorn, candy, etc., rose 16 percent.

* * *

**Aid for Weary Travelers**

The Ohio Turnpike Commission is going to help motorists find overnight sleeping accommodations along its 241-mile toll highway. The motive is not merely courtesy but an effort to cut down accidents. It is hoped that it will induce tired and sleepy drivers to stop sooner for the night than they might if obliged to search for lodgings. A luminous 16x20-foot sign will be erected 3 miles ahead of each interchange near which suitable accommodations are available. It will bear the legend, "Motel Area—Next Exit—Inquire at Toll Plaza." A smaller sign near the plaza will direct travelers to the proper exit ramp. The toll collector will hand out a leaflet listing the names and locations of approved stopping places and containing a map of the turnpike. In return for being listed, owners of establishments included must agree to keep their places clean and sanitary and not overcharge guests.

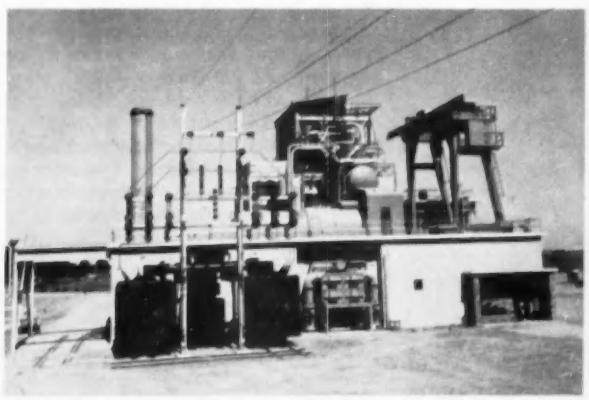


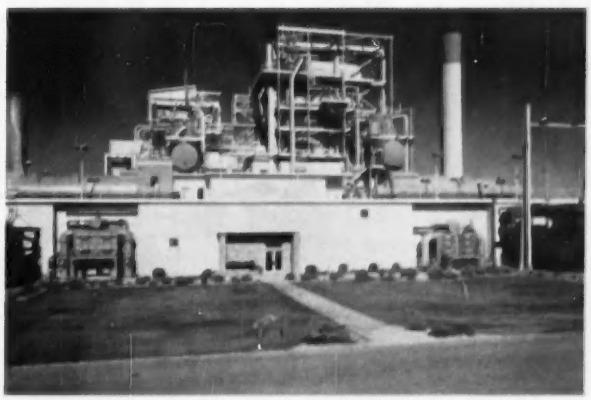
**MEET THE WEIGHT-LIFTING CHAMPION**

In the recent test in the Gulf of Mexico, this new sheer-leg derrick lifted a record 800 tons, which is the equivalent of 530 Ford automobiles. The monster was flexing its muscles in preparation for the job of helping to construct platforms for offshore oil-well drilling rigs. The derrick was built for J.R. McDermott & Co., marine contractor, of Harvey, La., by American Hoist & Derrick Company, St. Paul, Minn. It is stationed on the stern of a 90x300-foot barge that required 2000 tons of steel and 40 tons of welding rods for its construction. The derrick is 240 feet high and, when rigged for work, uses 9 miles of wire rope.

**Business Started By Chance**

Most businesses are planned, but now and then one is the result of chance. That was the case with the seedling concern of the present American Air Filter Company, Inc., one of the leading producers of equipment for filtering air taken in by compressors. The recent death of W.M. Reed, founder and late board chairman of the company, called





**A POWER PLANT GROWS**

In February 1953 we described man's efforts to rehabilitate the once desert-like Salt River Valley in Arizona through water conservation and to help it grow by supplying adequate electrical energy. At that time the first unit of the Kyrene Steam Central Station of the Salt River Power District was nearing completion; recently Unit No. 2 was put in operation. The pictures show the plant as it was in 1953 and as it is today. The original installation had a capacity of 37,500 kw; the new one can generate about twice as much power, thus tripling the output. The design of both units is approximately the same except for size. Note that the area is now landscaped and that the stone-trimmed entrance has been shifted from the right-hand edge to the center. On either side of it are the surface condensers that receive the steam discharged from the respective generators mounted above them.

attention to its origin. Reed began his career as operator of an automobile painting company in Louisville, Ky. He had so much trouble coping with dust that settled on freshly painted cars that he began experimenting with air-filtration devices. He met with enough success to organize an engineering company which, in turn, led to the formation in 1922 of the Reed Air Filter Company, forerunner of American.

* * *

**Huge New Stripping Machines**

The German coal-mining industry soon expects to be able to dig coal by the open-pit method from seams 800 feet below the general ground surface by the use of newly developed rotary-type excavators that work on the same principle as trenching machines utilized in this country. The first of the new units has been delivered to the Rhenish Brown Coal Mining & Briquette Manufacturing Company by its German makers, Koppel & Lubecker Maschinenbau, and is reputed to be the largest piece of equipment of its kind in existence. The monster weighs 5500 tons, is 656 feet long, and cost approximately $4.4 million.

The revolving, digging bucket-wheel is 32 feet in diameter, and around its perimeter are twelve buckets each with a capacity of 4.7 cubic yards. The wheel is at the end of a 229-foot-long jib that permits the plant to dig up to 163 feet above and 20 feet below the level on which the machine rests. Excavated material is dumped onto conveyor belts and carried to a loading station for transfer into 125-cubic-yard trucks. It takes about 50 seconds to load one truck, and the machine has dug in excess of 130,000 cubic yards in a working day. The unit travels on nine crawlers each of which is driven by an electric motor. There are 126 motors of all types and sizes, and they consume 7380 kw, enough power to supply a city with a population of 60,000. An even larger excavator of the same type is now being built. The design was fostered because of Germany's great need of coal.

Meanwhile, a conventional shovel that surpasses any of its kind previously constructed has been placed in service in this country by Pittsburgh Consolidation Coal Company. It, too, will strip earth from a coal bed—in the Georgetown open-pit mine near Cadiz, Ohio—and is expected to handle 6500 tons an hour. Its huge dipper will take a 100-ton bite, which will be moved 90 feet by swinging the 150-foot boom and 92-foot dipper stick. It will return for another load in 50 seconds. The shovel weighs 2750 tons, is 147 feet high and travels on eight crawler treads that weigh 60 tons apiece. It is operated by sixteen motors that total 4650 hp.

**MARION'S MONSTROUS MOUNTAINEER**

This electric-powered shovel is 50 percent larger than its nearest rival. It was built by Marion Shovel Company which shipped it to its working site in Ohio in 125 railroad cars. The operator rides to his control room in an automatic elevator housed in the hollow 6-foot-diameter center pin on which the giant machine revolves.

* * *

**The Human Heart**

Hydraulic engineers may well envy the performance of the human body's marvelous pumping plant—the heart. According to the Medical Society of the State of Pennsylvania, this fist-size organ averages 70 "beats" a minute, 100,800 a day, 2,575,660 in a 70-year life span. With each beat it pumps five ounces of blood into the circulatory system. This amounts to 22 pints a minute, 1320 pints an hour, 4000 gallons a day. There are 100,000 miles of blood vessels in the body, and the blood makes a complete cycle in less than a minute—up to 3000 times daily.

* * *

**Taj Mahal In Sound Condition**

Recent press reports that the Taj Mahal is so badly in need of repair that it might be closed to tourists are denied officially by the Government of India. Since 1943, it is stated, a committee of engineers has regularly inspected the monument and recommended maintenance measures to counteract the ravages of time. For such repairs $63,000 has been spent during the past ten years. No claim is made, however, that the famous building has weathered its 300 years of existence unscathed. On the contrary, it is stated that "The Department of Archaeology has been fully aware of the existence of various cracks. . .attention to only some of which was drawn in the newspaper reports. These cracks, which were to be expected, do not by themselves constitute any danger to the structure and they are already on the program of repairs." It is also admitted that a part of an outer compound wall has collapsed. This happened in an area where private residences are located and which has, therefore, not been open to inspection. The damaged section is being rebuilt and other parts are being repaired.

The Taj Mahal, which has been called the supreme achievement of Mohammedan art, is a mausoleum of white alabaster built near Agra 1632-50 by Shah Jahan as the burial place of his favorite wife, Mumtaz Mahal.

## Trucking Firm Takes Shop to Trailers

THE Pacific Intermountain Express Company, one of the largest highway freight carriers in the western states, has a new wrinkle in servicing and repairing its trailers. Instead of putting the trailer in the shop, the shop is taken to the trailer.

The shop in this case is a specially equipped truck called a "Yard Doctor." It carries an air compressor and receiver, a grease tank, tire rack, ladder and hoses for lubricating as well as inflating tires and operating pneumatic tools such as lug-nut wrenches. Mechanics traveling with the Yard Doctor check and repair trailer air and electrical systems, apply grease, check brake linings, inflate or change tires and perform other normal shop services.

**SAVING TIME**

While a trailer is being loaded, mechanics working from the Yard Doctor alongside grease the landing gear and check the refrigeration unit.

**ON THEIR WAY**

Having serviced one trailer, mechanics mount the Yard Doctor and move on to the next job. The mobile shop saves many man-hours every day.

According to C.P. Palin, the line's manager of transportation and properties, the mobile unit appreciably speeds up the work. Trailers can now be attended while being loaded at a dock or standing idle in a terminal storage yard, and it is no longer necessary to use special equipment to haul them into the shop. It is stated that the innovation saves at least one man-hour per trailer during routine checks.

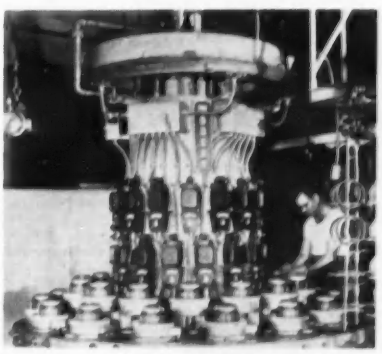
Pacific International has six of the Yard Doctors and will add more. Two are in Los Angeles and two in Oakland, Calif., and one each in Portland, Oreg., and Denver, Colo. The units were built in the Denver shops.

## Machine Assembles Brake Bands As It Turns

HIGH output of bonded transmission brake bands is obtained by a merry-go-round machine designed and built by Modern Industrial Engineering Company for the Gear Division of Borg-Warner Corporation. It has 30 stations which are loaded and unloaded manually, and the entire operation is completed automatically in one cycle. Two thicknesses of bands are handled at the rate of 180 for the heavy ones and 240 for the thin ones, the machine making a round in 10 and 7½ minutes, respectively.

At the start of the cycle the operator puts an adhesive-coated molded lining in the metal brake band, places the assembly on a segmented mandrel and lowers the bonding fixture. Each station is equipped with an air-regulating valve, temperature control and a pneumatic cylinder which expands the mandrel to hold the lining against the band to which heat and pressure are applied. As the worktable rotates, a cam on the outer periphery of the machine releases the pressure temporarily to allow the gases to escape and to insure a firm bond. At the completion of the cam travel pressure is again exerted and maintained for the remainder of the cycle.

Curing is done at 185-200 psi pressure and at 435-450°F for the thick band and with 125-135 psi and 400-415° for the thinner one. Pressure at each station is set by means of a special gauging device. Shop air at 90 psi is used for clamping the parts during bonding. To avoid complete stoppage in case of breakdown at any one station there are five control panels each governing six stations so that any group can be cut out for maintenance or repair while the others continue production without interruption.



*Circle 1E on reply card*

# Industrial Notes

It's hard, slow work to secure steel straps on skid and pallet loads by manual effort, but it's an easy, fast job by aid of a new tool that automatically tensions the bands and then seals and cuts them off in two motions. That is the report of the Signode Steel Strapping

Company, manufacturer of the Model AP machine shown in operation in the accompanying illustration. Powered by compressed air, the portable tool is designed for use with ⅝- or ¾-inch strapping and is provided with a magazine that holds 75 seals. It has undergone service tests in paper, lumber, steel fabricating, aircraft and other industries and is said to apply uniform, predetermined tension adjustable up to 1600 pounds and to insure a strong joint.

*Circle 2E on reply card*

It is reported that a new method of mounting industrial diamonds will increase the service life of diamond tools up to nine times. The stones are brazed to the tool under a vacuum, argon or hydrogen atmosphere using a silver-copper solder and titanium hydride as a wetting agent.

An 80-ton abrasive-belt-type grinding machine has been installed at a cost of $250,000 in a plant of The Carborundum Company, at Niagara Falls, N.Y. Called the largest of its kind, it will do grinding for customers on pieces ranging from relatively small castings to 40-foot-long aluminum wing skins for airplanes. It is suitable for work on a wide range of materials from wood to stainless steel.

One of the oldest manufacturers of field-office trailers is now building a low-cost mobile unit for use on construction jobs as a change room for workmen, office, machine shop, storage or tool room, or for any other similar purpose. It has a weatherproof exterior and door, a marine plywood floor, three windows that open and is insulated for comfort. The trailer has 100 square feet of floor area and provides about 670 cubic feet of storage space. Known as the Model 17-U, it is a product of International Trailer Company, Inc.

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The draftsman's familiar T-square may be replaced by a recently invented K-square which combines the T-square, triangle and ruler into one easy-to-use tool. It has a center piece to which is attached a slide that is adjustable over the entire range of 360°, thus permitting lines to be drawn at any desired angle to the horizontal. One of the more interesting things about it is that its inventor, Lawrence Kalmis, is only sixteen years old and still in high school in New York City. He is a member of Junior Achievement, Inc., a group that helps teenagers form and conduct small-scale business concerns so they can gain first-hand information on business practices.

*Circle 4E on reply card*

Some of the outstanding characteristics claimed for a new pressure indicator recently introduced from Switzerland by Kistler Instrument Company are attributed to the quartz-crystal transducer and to the patented "composite diaphragm" of the gauging element. The use of crystalline quartz insures accuracy because the mineral is little affected by temperature and virtually immune to


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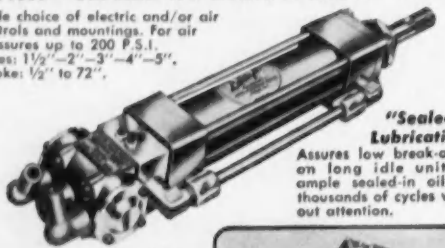
AIR MOTORS

WITH "SEALED-IN LUBRICATION" Pat. Pend.

Wide choice of electric and/or air controls and mountings. For air pressures up to 200 P.S.I. Bores: 1½"—2"—3"—4"—5". Stroke: ½" to 72".



"Sealed-in Lubrication" Assures low break-away on long idle units — ample sealed-in oil for thousands of cycles without attention.

"Sealed-in Lubrication"

AIR CYLINDERS 1½" to 8" bore

3 or 4-Way AIR POWERED VALVES

Air or electrically operated.

COMBINATION VALVES Panel units, hand and foot operated valves. Wide range of models.

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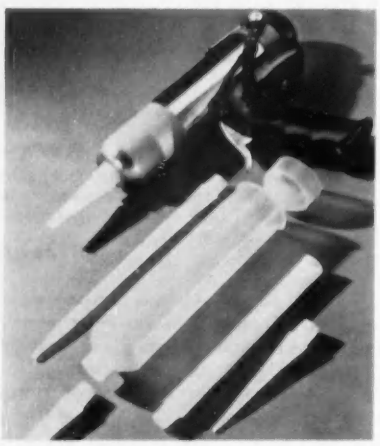
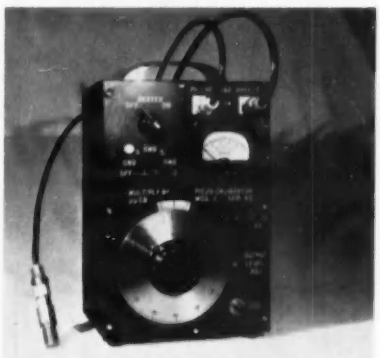


## ONE-USE SPRAY-GUN PARTS

A new air-powered gun for applying sealants to aircraft and other units under assembly utilizes disposable cartridges and nozzles molded of Tenite polyethylene. A cartridge containing a calking compound fits into the gun barrel and a threaded nozzle, available in varying sizes and shapes, is screwed into the front end of the cartridge. When the supply of sealant is exhausted, or the job is completed, the plastic parts can be discarded to eliminate cleaning time and costs.

*Circle 5E on reply card*

aging effects. The diaphragm is constructed both to isolate the pressure-sensitive element from stresses and strains in the outer housing and to withstand the full combustion pressure. It consists of a soft, corrugated Inconel ring that seals off the combustion gases while tiny wedge-shaped steel pieces, which bridge the gap between the housing and the inner element and support the soft diaphragm, resist the pressure. Known as SLM Pressure Gauge, the instrument is recommended for monitoring the operations of diesel and aircraft engines, rocket motors and hydraulic systems and can be used with analyzers to ad-



just a machine for optimum performance and to indicate and locate any trouble. No cooling is required, and the initial calibration will, it is claimed, generally suffice for the life of the gauge. The latter is normally used to measure all pressures from 0 psi to 3000 psi. With a high-pressure adapter, this range can be extended to beyond 20,000 psi. The instrument also measures vacuum.

*Circle 6E on reply card*

An automatic cycle timer that can be readily adapted for use with any air-operated equipment where consistent, accurate air cycling is required has been announced by Model Machine Company, Inc. The apparatus can be set to supply air for a predetermined interval ranging from one-quarter second to 60 hours, depending on the model in service. The time cycle is said to remain constant regardless of the air pressure applied. Sturdy and compact, the unit also contains an auxiliary electrical circuit to trigger a hopper, selector, solenoid, etc., that may be used in conjunction with the pneumatic equipment, as well as a manually reset digital counter to keep a check on production.

*Circle 7E on reply card*

For service where height or distance makes it difficult if not impossible to read a thermometer, and where all the operator wants to know is that the temperature remains constant, W.C. Dillon & Company, Inc., is offering an instrument that tells him the story at a glance even if he is 50 feet away from it. This is accomplished by a bright-red disk mounted on the pointer of a standard thermometer and by an opaque disk of the same diameter fastened on the outside of the dial glass where it coincides exactly with the warning disk and normally keeps it covered. Any variation in temperature will cause the needle to fluctuate and to reveal the red disk, a signal to the operator that he must take steps to bring the temperature back to normal. The position of the opaque disk can easily be changed in case of a new temperature setting.

*Circle 8E on reply card*

To fill the gap between its standard Airhydropumps and hand pumps, Davies Brothers has developed a unit that measures only 12x3¼ inches and weighs 16¼ pounds. It is available in six models exerting up to 10,000 psi hydraulic power with 100 psi air-line pressure. Once set, it works automatically and needs no adjustment, an air-reducing and control valve making it possible to produce but not to exceed any desired pressure within its range. On a closed circuit the unit is said to maintain that pressure for an indefinite period without consuming compressed air, leaving the operator's hands free to perform his work. The junior pumps have no metal-to-metal moving parts and are made of noncorrosible materials for use with water or oil. They

are suitable for testing valves and small fittings and, as a source of power, for operating small presses, rams, clamping devices and other hydraulic mechanisms.

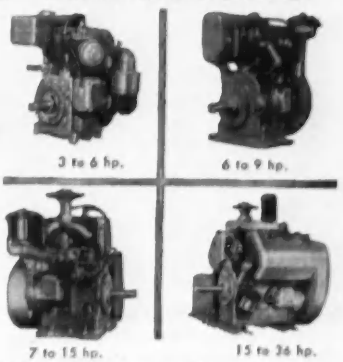
*Circle 9E on reply card*

Though designed primarily for air-conditioning installations, the pipe insulation shown has many applications in other fields. Called Protekto-Flex, it consists of Fiberglas fine-fiber Aerocor insulation, a tough plastic vapor-barrier jacket and a zipper that is said to insure a water-, air- and moisture-tight seal. The cover is resistant to oils and grease, bacteria, fungus, acids, alkalies and other


# "WISCONSIN ENGINES"

*offer the solution to your*

**POWER PROBLEM**




Next to the basic machine itself, one of your major problems is to select and specify a power component that matches both the equipment and the work it is to do . . . *most advantageously.* Wisconsin Heavy-Duty Air-Cooled Engines merit your critical and serious consideration because:

• Every Wisconsin Engine is of HEAVY-DUTY design and construction in all details . . . with the inbuilt stamina to *take it* under all operating conditions, in any climate, at all temperatures from sub-zero to 140° F.

• The Wisconsin line provides the most complete power selectivity to fit both the machine and the job . . . 12 different models in 4-cycle single cylinder, 2- and 4-cylinder types in a power range from 3 to 36 hp.

Wisconsin Engineers will be glad to co-operate with you in adapting Wisconsin Air-Cooled Engines to your original equipment *most advantageously.* Tell us about your problem. "Spec" bulletins available on all Wisconsin Engines.

**WISCONSIN MOTOR CORPORATION**

*World's Largest Builders of Heavy-Duty Air-Cooled Engines*

MILWAUKEE 46, WISCONSIN

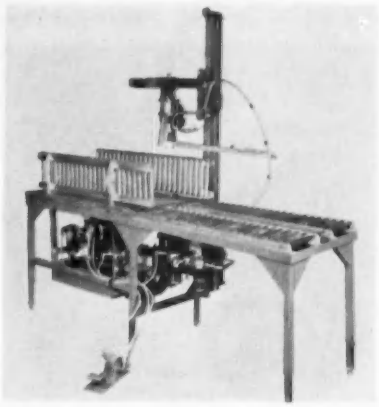
A 8702-½

*Circle 16A on reply card*

corrosive substances and, being flexible, adjusts itself to bends. It is made by Miracle Adhesives Corporation for ½- to 4 ⅛-inch copper tubing carrying cold or hot water (temperature range from 32 to 350°F) and in gray, gray-green, black and white. Special sizes and colors are available. Protekto-Flex is distributed by the Owens-Corning Fiberglas Corporation.

*Circle 10E on reply card*

Quick and sure stapling of packed center-slotted corrugated and fiberboard boxes is insured, it is reported, by a new model stapler announced by Container Stapling Corporation. The CSC-2 handles cartons from 2 to 25 inches wide, 2 to 46 inches high and of any length. It staples their top and bottom flaps simultaneously as they travel along on a conveyor table top with telescoping legs that permit adjusting the working height from 21½ inches to 33 inches. The two stapling heads are powered and controlled entirely by compressed air and are ready to function as soon as the supply line (minimum air pressure 60 psi) has been connected to the machine. The lower head holds 350 staples and is provided with an air-operated whistle that blows when the magazine needs reloading. This head may be made inactive if not required. The upper head, with 250 staples, is attached to a carriage which is actuated by means of a drawbar that permits positive engagement at regular intervals. The drawbar

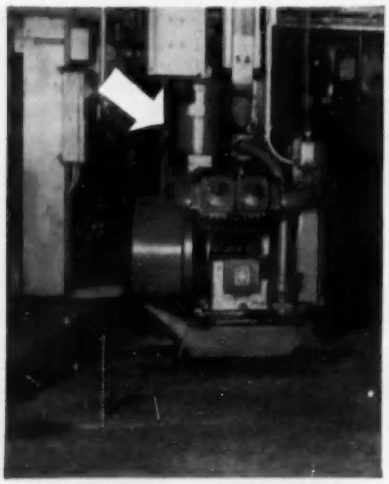


is controlled by a pneumatic cylinder and has a vertical movement of 12 inches. The upper head is actuated by a foot valve and remains in the "up" position until the operator depresses the pedal, thus preventing accidental descent. It is also hinged to prevent damage to machine or package if an attempt is made to close a small carton before a higher one has cleared the magazine. In the case of boxes with bulging contents, the operator is free to manipulate a separate valve to control the centering and compression device, work that is normally done automatically.

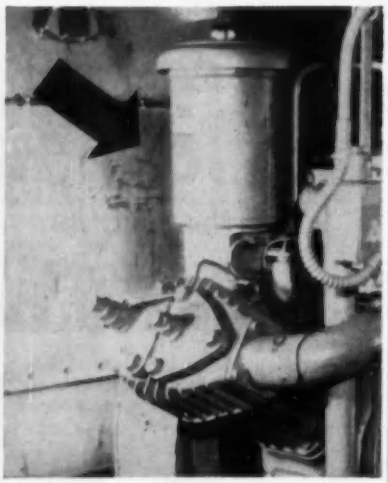
*Circle 11E on reply card*


# Whether you make chemicals or current...

## *Air-Maze filters will keep your compressors on the go!*



**AT THE BRIDGEFIELD, PA. PLANT** of a large manufacturer of chemicals, control instruments are a vital part of production. The compressor pictured above supplies them with air. And, of course, it's equipped with an Air-Maze oil bath filter-silencer. The Air-Maze oil bath scrubs intake air clean in a bath of oil, reduces maintenance costs and downtime. The silencing feature quiets compressor intake noise.



**THIS COMPRESSOR SUPPLIES AIR** day in, day out at the new addition of the Jamestown Municipal Electric Plant, with the help of an Air-Maze oil bath filter-silencer. By keeping intake air clean, it keeps airborne dirt from damaging pistons, cylinder walls, rings, valves and other vital parts. This reduces overhaul costs, insures smooth operation. The silencing feature saves wear and tear on plant personnel.

**AIR-MAZE** The Filter Engineers

**AIR FILTERS • SILENCERS • SPARK ARRESTERS**

**LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS**

**25000 Miles Road • Cleveland 28, Ohio**

*Circle 17A on reply card*

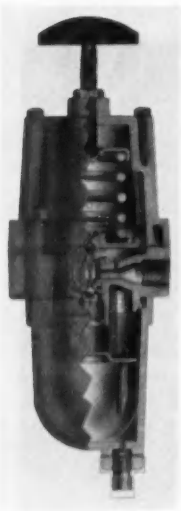
**"You're right on time for dinner tonight. What happened, plant burn down?"**

Excessively long tamping poles that are awkward to handle may have had their day if the new sectional rods announced by Ideal Explosives Supply Company do their work effectively. The sections are 1½ inches in diameter and made of Douglas fir. They are easily connected by nonsparking joints of magnesium bronze to provide a pole that can be lengthened progressively, as required.

*Circle 12E on reply card*

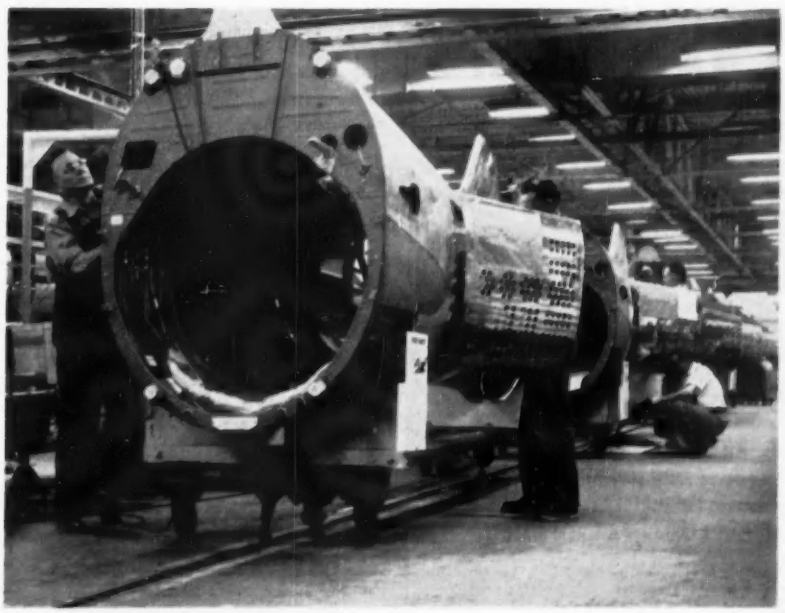
From Du Pont's *Neoprene Notebook* we learn of the development of a simple device for cleaning sewers and water mains. It consists of a ribbed neoprene ball that is tied to a heavy line and inflated with compressed air until it fits the pipe snugly. Lowered through a manhole, a 15- to 20-pound tension is maintained on the rope as the sphere is carried downstream by the flow in the conduit. When the head of water exceeds the air pressure in the ball, a jet of water issues from beneath the latter and sweeps the sediment ahead of it while the ribs scrape the slimy deposit from the walls.

For pneumatic instrumentation and other installations requiring extreme sensitivity of pressure output in small volumes, Black, Sivalls & Bryson, Inc., has developed an air or gas regulator that is said to provide the close control demanded. Known as Type 73-26, it has a die-cast aluminum-alloy body, internal parts of stainless and plated steel, and diaphragms and O-ring seals of synthetic materials. Because of its light weight it can be supported by its piping, but may be panel or bracket mounted. It features a 40-micron filter impregnated with phenolic cellulose and provided with a drain valve that operates whether the regulator is in the horizontal or vertical position. Maximum input pressure is 300 psig; output pressure, 40 psig; with special spring, 100 psig. According to the manufacturer, the instrument responds instantaneously to changes in flow; has minimum pressure drift from the set point and is easily adjusted to within close limits for any pressure within its output range.



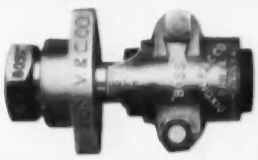
*Circle 13E on reply card*

If you're a draftsman you might find it convenient to have an India ink that can be rubbed out with a regular pencil



**SNAIL'S PACE**

This assembly line for F-84 fighter-bomber planes at Temco Aircraft Corporation's Dallas, Tex., plant moves at a top speed of 8 feet per hour and can be slowed down to a pace no faster than the growth of an asparagus shoot. It is sometimes necessary to stand on the drag chain to find out if it is moving. Power for this slow motion is provided by a ¾-hp electric motor that is at times geared down to a ratio of 70,000 to 1. Assemblers formerly moved the line by hand at prescribed intervals, but that necessitated stopping work for ten minutes and cost twelve man-hours of production time. The planes that are assembled so deliberately can fly 650 miles an hour.



**"GJ-BOSS"**

**GROUND JOINT AIR HAMMER COUPLING**

The strongest and most efficient coupling for every type of air and pneumatic hose . . . and it requires no washer to keep it leakproof. Ground joint design provides a perfect soft-to-hard metal seal between end of stem and spud that is not affected by grit or dirt. Extra gripping power is assured by the superstrong "Boss" Clamp, with heavily reinforced extensions to engage collar on coupling stem. Compact Style, ½" and ¾". Heavy Style, ¾" and 1". Cadmium plated—rustproof.

**"No. 3500" STEEL NIPPLE**

A quality nipple that does a real coupling job inexpensively. Machined from cold drawn steel bar, with large-capacity bore and deeply corrugated, smoothly finished shanks. Collar back of hex portion engages extended anchoring fingers of "Boss" or "Air King" Clamps. Hose sizes from ¼" to 1", in various hose and I.P.T. size combinations. Cadmium plated—rustproof.

*Stocked by Manufacturers and Distributors of Industrial Rubber Products*

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DIXON VALVE & COUPLING CO., LTD., TORONTO Associate Companies

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# If the Job Calls for VENTILATING . . .

Actual photo during exhausting of explosion gases.

## . . . Your best bet is NAYLOR PIPE

When you consider ventilating lines, Naylor Spiralweld pipe stands out in two basic ways.

From a structural standpoint, the Naylor spiral truss adds extra safety and collapse strength for both pressure and vacuum service. Its exclusive structure permits the use of lighter gauge material for lower cost without sacrificing performance.

From an installation aspect, when connected with the one-piece Naylor Wedge-Lock coupling, Naylor lines can be installed faster than by any other method. With this combination, lines hug the wall and space is saved as they can be made up with only one side of the pipe in the open. And its light weight makes Naylor pipe easy to handle and extend as work progresses. Sizes from 4" to 30" in diameter and uniform lengths to 40 feet.

**Write for Bulletins No. 507 and No. 514 for complete details.**

NAYLOR PIPE

**NAYLOR PIPE COMPANY**
**1245 East 92nd Street**
**Chicago 19, Illinois**

Eastern U. S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

*Circle 19A on reply card*


eraser. Artone Color Corporation says that it has produced an ink of this kind that can be erased quickly without smudging. Called E-Z Rase, it is waterproof and free-flowing and may be fixed for permanence, if desired.

*Circle 14E on reply card*

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New concrete can be bonded to old and plaster to green cement before the latter is completely cured by the use of Clinch-T, a liquid produced by Dasco Chemical Company, Inc. Applied with brush or air spray, it is said to have a shear strength of 2500 psi, to be nontoxic, to resist most acids and to be unaffected by the alkalinity of gypsum, lime-putty, plaster or Portland cement. One gallon is enough to cover a surface of 350 square feet.

*Circle 15E on reply card*

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For pneumatic loading and gauging applications, the Governaire Division of Bellofram Corporation has developed a regulator of new design that is said to be uncommonly accurate and reliable and to insure faster response and better than normal control. Eight types, including pressure regulators, volume boosters and reversing relays, are now in production. Five of them, the Series 4000 available in a pressure range from 10 to 250 psi, have high-capacity supply and exhaust seats $\frac{5}{8}$ inch in diameter, as shown in the accompanying illustration; the three others are $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$ inch in size and have two $\frac{1}{4}$-inch gauge taps. Designated as the Series NPT, it is especially well suited for the control of welding-head pressures, punch-press brakes and clutches, and cable and sheet tensioning devices. The new regulator is named Governaire.

*Circle 16E on reply card*

## *BRIEFS*

A supermarket recently constructed in Fort Wayne, Ind., is so large that a high-school football team practiced in it last fall before the concrete floor was laid.

•

Toy electric trains may be a plaything, but in the laboratory of the Hanford Atomic Energy Commission plant they are serving a very important function. Run by remote control, they are transporting small amounts of radioactive materials so as to reduce the risk of exposing scientists to radiation. Varying track arrangements enable the trains to deliver their harmful cargoes to different parts of the laboratory.

•

Motorists in the United States are certainly being pampered. Now they may be spared the trip to the courthouse to pay traffic or parking fines. The American Bank Equipment Company had designed a slot machine that is mounted near the curb into which the violator inserts the ticket, deposits the fine and cranks a lever to get a receipt. The tickets are of special design and the collector can be adjusted to take sums of varying amounts in silver.

•

In the past, metal spraying has mostly been confined to maintenance and repair work. Now, through the development of automatic controls, it has entered the production field where it is finding steadily increasing application.

•

Freight cars with five compartments and doors that roll up into the roof are an innovation in railway rolling stock. Each compartment is accessible from both sides and has a usable space of 672 cubic feet. Unloading time per car, ten minutes.

•

The first large underground steam generating station now underway in Sweden will use the two biggest boilers so far put in service in Europe. Each

"Gregory likes to eat alone"


**18** TYPES OF PRODUCTS TO MEET YOUR SPECIFIC NEED

# Here's a GALAXY OF FRANCE PACKINGS and PISTON RINGS

*used by*

**LEADING COMPRESSOR BUILDERS**
**gas, oil and chemical companies**

• General Type Packings • Hyper Compressor Packings • Refrigeration Packings • Steam Packings • Gas Engine Packings • Sheathed Bronze Fire Checks • Oil Wiper Packings • Hi-Lead Bronze Packings • Carbon Packings • Carbon-Bakelite Packings • Valve Discs (Steel & Bakelite) • Carbon Bakelite Segmental Piston Rings • Bronze Segmental Piston Rings • Carbon Bakelite Piston Rings • Liquid Pump Piston Rings • Power Piston Rings • Chrome Plated Piston Rings • Teflon Piston Rings . . . and many other types of rings and packings for special operations.

**FRANCE**
**Packing Company**
**Phila. 15, Pa.**

SINCE 1898

*For Full Information — MAIL COUPON NOW!*

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Title .....

Company .....

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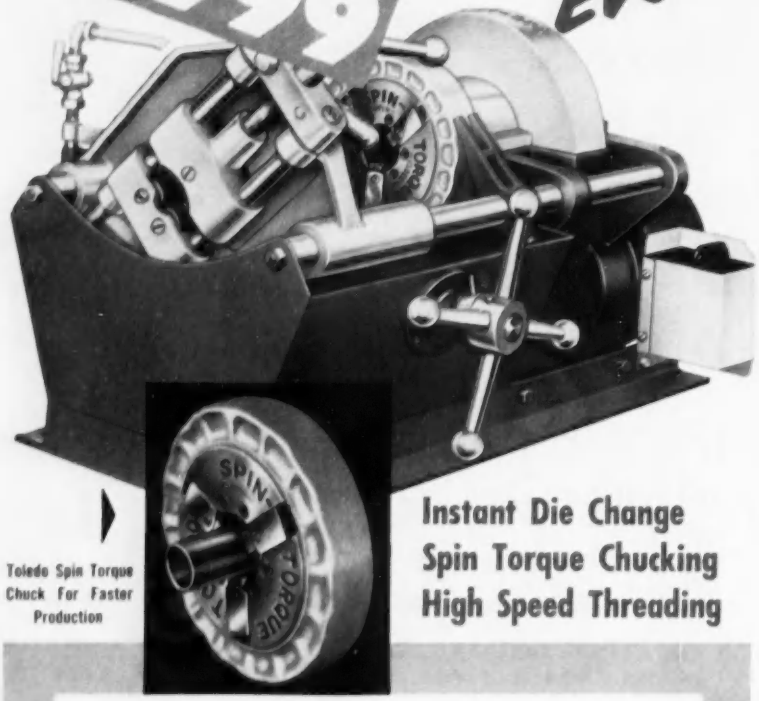
# TOLEDO

Faster Than Ever!

No. 999



Toledo Spin Torque Chuck For Faster Production

**Instant Die Change**
**Spin Torque Chucking**
**High Speed Threading**

Quick change features of the TOLEDO No. 999 Pipe Threading Machine have proved real time and money savers on hundreds of jobs. Now . . . with the addition of the Toledo Spin Torque Chuck even faster production is provided. Instant changeover from cutting to threading . . . Spin Torque Chucking—a quick spin and pipe up to 2" is locked in the chuck—no wrenches, no rocking, socking or hammering. Bench type or portable floor models, full ½ H.P. motor powers heavy gear train drive, finger tip controls. Remember—if it bears the TOLEDO label you know it's a dependable product. See it at your suppliers or write for complete information. The Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo 4, Ohio.

THE TOLEDO PIPE THREADING MACHINE CO.
1445 SUMMIT STREET TOLEDO 4, OHIO

BUILDERS OF THE WORLD'S FINEST PIPE TOOLS

TOLEDO®

PIPE THREADERS • PIPE WRENCHES • PIPE MACHINES

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will deliver 465 tons of steam per hour and will operate at 995°F—high enough for the steam tubes to glow dark-red. Each turbogenerator will occupy a separate 330x80-foot rock chamber 100 feet high. Cost of the power plant ($57 million) will be about 10 percent more than if it were being built on the surface.

•

The navy's newest icebreaker, the U.S.S. *Glacier*, is equipped with fully reversible propeller-type pumps just to rock the boat in a timed cycle to keep it free from the grip of solid ice. They can shift 320 tons of sea water from one side of the vessel to the other in as little as 85 seconds.

•

With a new type of paint spray gun it is possible, we are informed, to achieve a variegated effect at one application. Three colors are used and remain separate from one another during the spraying process because they are kept in chemical suspension.

•

Two-thirds of the world's 90 million motor vehicles are registered in the United States. More than 13 percent of American car-owning families have two or more. Nearly half (46 percent) of the automobiles in this country are parked outdoors overnight.

•

America's first commercial dynamite was made in 1867 just outside of San Francisco, Calif., by Giant Powder Company. In 1880 operations were shifted to Richmond, Calif. The plant there, now modernized and owned by the Atlas Powder Company, is celebrating its seventy-fifth anniversary.

•

General Electric Company predicts that ten years from now each worker in the United States will be using as much electricity as it takes to light 1000 one-family homes. Other forecasts made are: a one-third increase in worker output, 50 percent greater expenditures for plant and equipment and a rise of 110 percent in community electrification and 117 percent in farm electrification.

## Books and Industrial Literature

The tenth edition of *Standards of the Hydraulic Institute* is now ready for distribution and in its completely revised form is a source of the most comprehensive and authoritative information on hydraulic pumps. In arrangement and format it differs from the earlier publications. A loose-leaf index is included, and a revision-notification service enables buyers to keep their books up to date by replacing individual sheets as changes are made. The new edition is broken down into five sections: general, centrifugal pumps; rotary pumps; reciprocating pumps: and data. Those on pumps are uniform in arrangement and cover classification, nomenclature, application, rating and testing and give installation, operation and maintenance instructions. Also included are numerous examples of mathematically solved problems dealing with complex aspects of the field. Clarity and understandability have been stressed throughout the preparation of the Standards so as to serve hydraulic engineers and designers as a working tool and college professors and students as a textbook. Published by Hydraulic Institute, 122 East 42nd Street, New York 17, N.Y. Price, domestic, $4.75; foreign, $5.25.

*Pneumatic Equipment*, second edition, published by the British Compressed Air Society, 32 Victoria Street, London S.W. 1, England, details in layman's language the characteristics, features and uses of a wide variety of pneumatic equipment including accessories such as filters, regulators, etc. Compressed-air theory and general operating and installation procedures are discussed, as well as some standard British tests in connection with air capacities, etc. Of 210 pages, the handbook is profusely illustrated and incorporates a buyer's guide with a classified list of some 250 separate items available from the society's member companies. Price, 20 shillings (about $2.80).

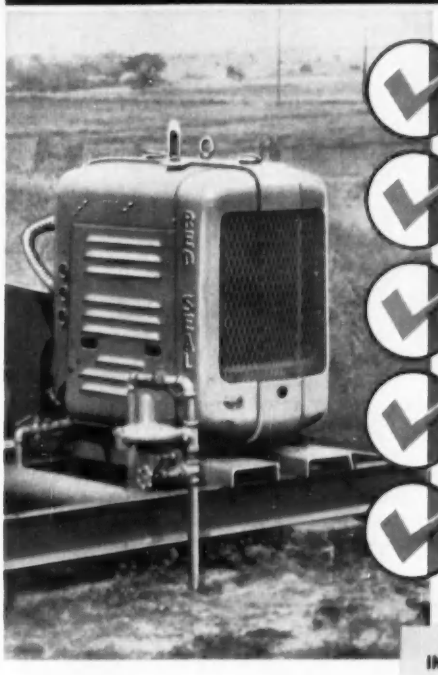
In his *Handbook of Barrel Finishing*, Ralph F. Enyedy presents for the first time in book form the complete story of this economical method of finishing metal and plastic parts. The 225-page volume describes every phase of the work from cleaning and deslugging to coloring, polishing and burnishing and includes more than 150 specification sheets. A Westinghouse industrial engineer, Mr. Enyedy has devoted much time to research in this field, has several developments in tumbling to his credit and set up standards for barrel-finishing methods. Publisher, Reinhold Publishing Corporation, 330 W. 42nd Street, New York 36, N.Y. Price, $7.50.

The Colorado Fuel & Iron Corporation, which has an exclusive contract with the Bart Manufacturing Corporation for nickel-plating its steel-plate products, has published a manual presenting the manufacturing techniques and fabrication procedures such as forming, welding, cleaning, handling and testing of the Bart lectro-clad nickel-plated products which it is offering through its numerous sales offices in the United States and foreign markets.

*Circle 17E on reply card*

A brochure describing a new approach to supervoltage radiography has just been published by High Voltage Engineering Corporation. Bulletin R is an informative treatment of the importance of radiography as an inspection and quality control tool. Also presented is a checklist of the major characteristics of supervoltage radiography that can serve as a guide to technical and management personnel in selection of the


CONTINENTALS GIVE YOU
ALL THE THINGS
that add up to
DEPENDABLE POWER



QUALITY assured by more than 50 years' experience in specialized internal combustion power.

ENGINEERING with each specific application in mind.

SPECIALIZATION that does away with hit-or-miss matching to the job.

PARTS INTERCHANGEABILITY for quick replacement, with minimum down-time.

AUTHORIZED SERVICE and genuine Red Seal parts available from coast to coast.

By standardizing on Continental Red Seal engines, you get ALL THE THINGS that add up to dependable power. There's a Red Seal model engineered and built for almost every application in transportation and industry, as well as on the farm. Overhead-valve and L-head models for use with all standard fuels are available as bare engines or as power units, open or closed. Bulletins and full information on request.

SERVICE
AND GENUINE RED SEAL PARTS
SOLD EVERYWHERE

IN ADDITION TO ITS LARGE ENGINES, Continental builds an outstanding line of heavy-duty air-cooled four-cycle models for industrial and farm applications requiring 2 to 3 h.p. Advanced engineering gives them easy starting, high dependability, and unusual lugging capacity at low speeds . . . Options: patented and exclusive Contex® external ignition system, low-level ignition cut-off, 6-1 reduction gear, and other features. Available also for use on kerosene . . . For information on these models, address Air-Cooled Industrial Engine Division, 12800 Kercheval Ave., Detroit 15, Michigan.

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VERTICAL SHAFT

Continental Motors Corporation
MUSKEGON • MICHIGAN

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1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GA.

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# See...Don't Guess

## Install NUGENT Sight Feed Valves for LUBRICATION CONTROL

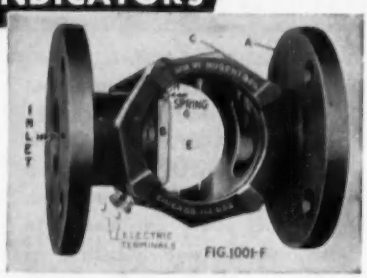
13 models designed for working pressures to 125 psi. Sizes to ¼ inch.

9 models for large machinery. "Swivel and lock" type for sight chamber adjustment to most convenient view position.

Medium size needle type with steel valve stem. 9 models. Sizes to ¼ inch.

WITH a Nugent Sight Feed Valve in your oil line, you can tell at a glance whether or not vital parts are receiving proper lubrication. Nothing is left to chance and there's no guess work involved. Oil flow through the valve is controllable from 2 drops per min. to 21 gals. per hour depending upon oil viscosity and valve model. All are vented to prevent air binding. Glasses and screens are removable for cleaning without interrupting oil flow.

## SIGHT FLOW INDICATORS




Sight Flow Indicator available with tapped or flanged connections. Removable windows. Can be installed right or left hand or vertically.

ANOTHER NUGENT instrument for solving lubrication problems is the Sight Feed Indicator. Installed in a machinery oil system, this device sounds an alarm when oil is not getting to bearings. When oil is not flowing properly, Indicator "B" (See Fig. 1001-F) closes making contact with terminals "J". This sounds the alarm making it possible to locate trouble quickly, protect valuable machinery and save on costly down time.

For trouble free lubrication systems, write for descriptive bulletin on the Nugent Sight Feed, Sight Flow Indicator and other Lubrication Specialties.

**Wm. W. Nugent & Co., Inc.**
3434 Cleveland St., SKOKIE, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

*Circle 23A on reply card*


proper X-ray source, as well as case studies based on actual operating problems and their solutions.

*Circle 18E on reply card*

Portable and unit mills of service especially in proving small ore bodies are the subject of Bulletin No. M5-B5 obtainable from Denver Equipment Company.

*Circle 19E on reply card*

The Pyle-National Company has announced a pamphlet describing and illustrating its line of watertight sealing grips for portable cords and cables on electrical equipment of all kinds.

*Circle 20E on reply card*

For easy reference, The A.K. Allen Company has prepared a spiral-bound master catalogue descriptive of its complete line of pneumatic and hydraulic cylinders, air valves, clamps and dial-feed indexing tables.

*Circle 21E on reply card*

The Green Fuel Economizer Company, Inc., has published a bulletin, 172-CFF, that points out the features and advantages of its new packaged type Aerodyne dust collector for broad industrial application.

*Circle 22E on reply card*

Latest information on Flexaust hoses and Portovent ducts is given in Bulletin 60 released by The Flexaust Company. Anyone interested in dust collection, fume control, air conditioning and materials handling will find the publication useful.

*Circle 23E on reply card*

An 8-page bulletin obtainable from E.F. Houghton & Company gives factual information on its fire-resistant hydraulic fluid, as well as on installation systems and maintenance. Typical applications of Houghto-Safe are outlined.

*Circle 24E on reply card*

Bucyrus-Erie's 15-B excavator-crane, a ½-cubic-yard shovel designed to handle a wide range of excavating and lifting jobs, is described in detail in a 40-page booklet well illustrated with close-ups of its mechanical features and on-the-job views.

*Circle 25E on reply card*

For those who specify or buy valves, Lunkenheimer Company has prepared a circular descriptive of its new line of bronze solder-end globe, gate and check valves for general and industrial use on steam, hot- and cold-water, oil, gas and vacuum lines.

*Circle 26E on reply card*

Engineering data on forged stainless and alloy-steel fittings for high pressure-high temperature steam lines and process liquid and gas lines are contained, among other information, in Bulletin S-1-55 offered by Watson-Stillman Fittings Division, H. K. Porter Company, Inc.

*Circle 27E on reply card*

A new line of electric motors introduced by The Louis Allis Company are comprehensively described and illustrated in Bulletin 1700 that also gives essential performance data and lists applications. The series includes open drip-proof, enclosed and explosion-proof units.

*Circle 28E on reply card*

The Development & Research Division of The International Nickel Company, Inc., has issued an illustrated 38-page booklet on magnetostrictive transducers that are used to convert electrical input energy to mechanical output energy or mechanical input energy to electrical output energy. Written by Boyd A. Wise of the Battelle Memorial

Institute, it summarizes all practical experiments to guide engineers toward a workable design in exploring new fields in the sonic and ultrasonic regions. A copy may be obtained by writing to the Readers Service Section, The International Nickel Company, Inc., 67 Wall Street, New York 5, N.Y.

Bulletin 9619, an 8-page illustrated catalogue describing the construction and operational features of the new Type VS Class 2F Gyrol Fluid Drive for diesel-engine applications is available from American Blower Corporation. Typical installation views are included, as well as a special table of oil-cooler selection recommendations.

*Circle 29E on reply card*

A comprehensive bulletin—No. 100—of interest to engineers dealing with the measurement of liquid flow and its various ramifications has been prepared by Simplex Valve & Meter Company. It contains construction and installation data on its TG venturi tubes and nozzles developed for the process industries, power plants, testing laboratories and for main-line metering.

*Circle 30E on reply card*

Bulletin SF 155 released by the Industrial Divisions, U.S. Hoffman Machinery Corporation, deals with the design, use and installation of steel and zinc-coated fittings and tubing designed for low-pressure installations. Tubing is furnished in 12½ or 20 foot lengths from 2⅛ to 6 inches in diameter and is especially well suited for stationary pneumatic systems.

*Circle 31E on reply card*

*How to Care for Jr.* is the title of a folder being distributed by Reliance Electric & Engineering Company. It outlines a program that will help users of Reliance V-S Jr. Drives to keep them in peak-efficiency operation. It is intended primarily for maintenance engineers and includes a list of renewable parts.

*Circle 32E on reply card*

Air-line respirators and accessory equipment manufactured by Mine Safety Appliances Company are described and illustrated in Bulletin No. 1009-8 now available. They are designed to safeguard men working in atmospheres such as cutting fumes, toxic dust, paint-spray vapors and fumes from molten metals not immediately harmful.

*Circle 33E on reply card*

A general catalogue, No. 7115, on corrosion-, abrasion- and contamination-resistant rubber linings for storage and process equipment has been announced by Manhattan Rubber Division, Raybestos-Manhattan, Inc. Among other useful data it contains a guide for selecting linings for acids, alkalies, plating solutions and abrasive compounds.

*Circle 34E on reply card*

In a 14-page manual The B.F. Goodrich Company's Industrial Products Division discusses the care and maintenance of industrial V-belts. Topics covered include designing a new drive, installation, double matching, tension and how to clean and store belts. Typical causes of failure are shown on a service chart and ways to prevent them are outlined.

*Circle 35E on reply card*

Users of industrial or mechanical rubber goods can obtain a 72-page catalogue on hose, belting, packing, molded and lathe-cut mats, etc., from Hamilton Rubber Manufacturing Corporation, Meade Street, Trenton, N.J. Fully illustrated, it gives construction details and other pertinent data and lists applications. Requests should be written on company letterheads.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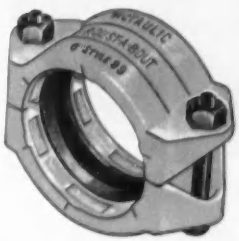
**VICTAULIC HAS EVERYTHING...**

**VICTAULIC COUPLINGS**
Simple, fast, reliable. *Styles 77, 77-D,* for standard uses with steel or spiral pipe, — *Style 75* for light duty. Other styles for cast iron, plastic and other pipes. Sizes ¾" to 60".



**ROUST-A-BOUT COUPLINGS**
For plain or beveled end pipe *Style 99.* Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 8".

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The new, boltless, speed coupling, *Style 78.* Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

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**VICTAULIC FULL-FLOW FITTINGS**
Elbows, Tees, Reducers, Laterals, *a complete line*—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".

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Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes ¾" to 8".

**PLUS FITTINGS AND GROOVING TOOLS**

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.
Write for NEW Victaulic Catalog-Manual No. 55

**VICTAULIC COMPANY OF AMERICA**
**P. O. BOX 509 • Elizabeth, N. J.**

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A warm welcome awaits you at Booth No. 328 during the A.S.T.E. Industrial Exposition (Tool Show) at Chicago, March 19 to 23.

Here you will receive advance information about NOPAK-MATIC... a complete new line of solenoid pilot operated, poppet-type valves to be introduced later this year. These valves are designed for a wide range of control applications from the simple operation of an air cylinder to the complex, precision operation of completely automated production machinery.

At the NOPAK Exhibit you will also find the new NOPAK Square Head Cylinders and such established products as standard NOPAK Cylinders in various classes of construction, NOPAK Disc-Type Valves, Reciprotrol Valves and V-Type Slide Valves.

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***VALVES and CYLINDERS***

**for AIR and HYDRAULIC SERVICE**

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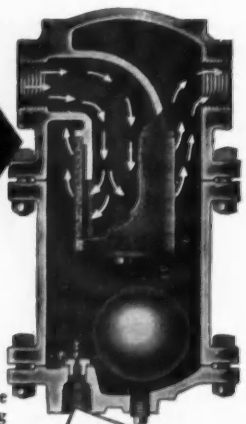

***Johnson Self-Draining Compressed Air Separator.....***

Like all Johnson Separators the new Type "SA" Self-Draining Separator combines the two most effective principles of removing moisture and dirt from compressed air:

1. Controlled expansion of air in separator precipitates most of the moisture.
2. A "thousand baffles" of coarse mesh repeatedly changes flow of direction to capture remaining foreign matter.

Johnson Separation Devices include Separators for Compressed Air or Steam, After coolers, oil absorbers.

Self-Draining—a simple but complete trap mechanism built right in, automatically drains separator whenever necessary.

WRITE FOR CATALOG

**The Johnson Corporation**

830 WOOD STREET • THREE RIVERS, MICH.

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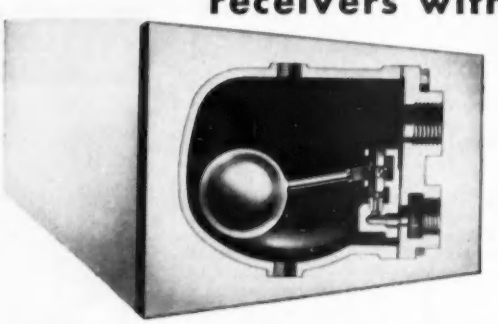
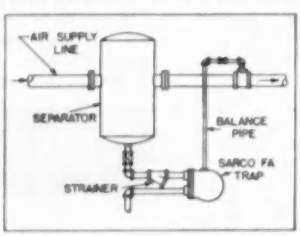
## Drain compressed air receivers with



## SARCO FA DRAIN TRAPS




Type FA Trap draining separator.

...also your intercoolers, aftercoolers and separators. These traps automatically release condensate as it forms... without the waste of air that occurs when blowdown valves are used. New technical bulletin No. 5-CA offers many suggestions as to how you can increase the EFFECTIVE capacities of your air compressors. Write today for your free copy. No obligation... of course.

513

**sarco COMPANY, INC.**

*Represented in Principal Cities*

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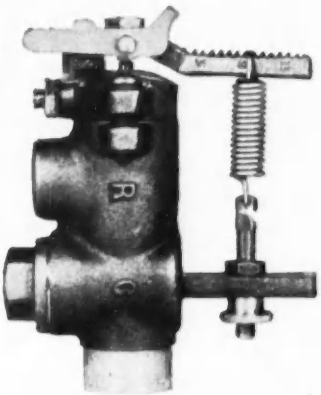
KEEP YOUR COMPRESSOR
AT TOP EFFICIENCY
AT LOW COST WITH A

# • CONRADER UNLOADER

STANDARD EQUIPMENT ON MANY NATIONALLY KNOWN AIR COMPRESSORS USED THE WORLD OVER!



Always fully opened or closed. Positive and instantaneous action.

Adjustable from 4 to 600 pounds operating pressure.

Easy to install - Operates in any position.

We offer a one-day repair service on any Conrader Valve regardless of age.

Your Problem Will Get Our Immediate Attention — WRITE TODAY

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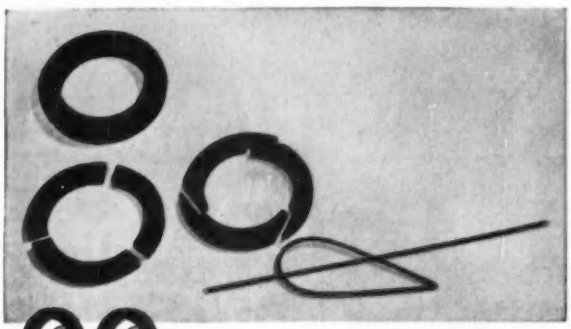

## Look to COOK for Better PACKING RINGS!

Whatever your packing-ring requirements, you can depend on Cook for a ring *design* and ring *material* that will deliver maximum efficiency at minimum cost.

One *source*, one high standard of *quality* — that's what you get when you specify Cook — packing-ring pioneers since 1888. Write direct for complete technical data. C. Lee Cook Manufacturing Co., 916 So. 8th St., Louisville 8, Ky.

**MATERIALS**

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*(Exclusive with Cook)*

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*(No. 1—Plastic Bronze)*
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**BABBITT**
*(Highly Anti-Frictional)*

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*(Laminated Bakelite: Standard, Hi-Temp and Graphitized)*

**CARBON**
*(For Non-Lubricated Service)*

**C. LEE COOK MANUFACTURING CO.**
*Sealing Pressures Since 1888*

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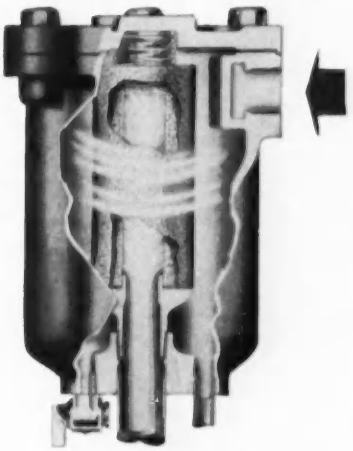
# Get Clean Air for Your Tools



# Adams *Poro-Stone* Air Filters SAVE MONEY · TIME

You get protection that counts with Adams Poro-Stone Air Filters. Damaging water, rust contaminated oil, dust and pipe scale are removed from your compressed air . . . and there's virtually no pressure drop across the Adams filter.

Separation of foreign matter is in two stages — by centrifugal action from the movement of the air itself . . . by diffusion through the permanent Poro-Stone filter tube.

Not only do you save money in longer tool life and trouble-free operation, but also you save time. That's because Adams filters are quick to clean . . . have no moving parts to wear . . . need no special tools . . . proper assembly is all but fool-proof.

For full details and prices, write today for your copy of New Bulletin 117.

**R. P. ADAMS CO., INC.**
**209 E. PARK DRIVE BUFFALO 17, N. Y.**

R. P. ADAMS COMPANY, INC. M-56
209 EAST PARK DRIVE
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Please rush me your New Bulletin 117 with sizes and prices.

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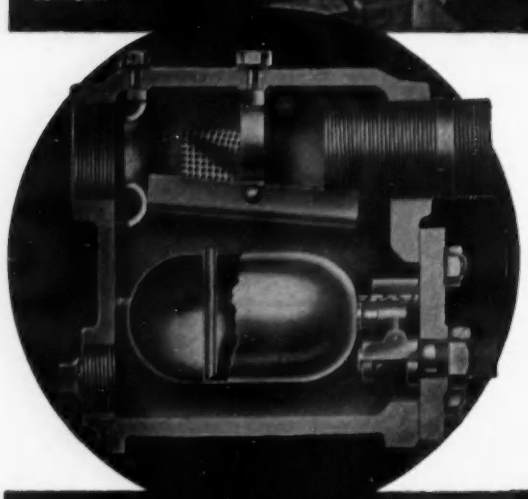
DRI AIR MAY BE INSTALLED BY SUSPENDING IT FROM THE PIPING WITHOUT ANY OTHER SUPPORT.

# INCREASED PNEUMATIC EFFICIENCY WITH THIS AUTOMATIC SEPARATOR



PROTECT EQUIPMENT WITH

# DRIAIR

**SEPARATES • COLLECTS • DELIVERS**

• DriAir separates and automatically ejects the condensed water and oil from compressed air lines, collects pipe scale and rust, delivers clean dry air to tools and other pneumatic equipment. This promotes better lubrication, reduces wear, increases life of tools and produces greater output. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent.

A TYPICAL INSTALLATION SHOWING DRI AIR STANDING ON A CONCRETE FLOOR NEXT TO THE WALL.

WRITE FOR BULLETIN DA WHICH FULLY DESCRIBES THE CONSTRUCTION AND OPERATION OF THE DRIAIR.

## NEW JERSEY METER CO.

*"SPECIALISTS IN COMPRESSED AIR DEVICES"*

PLAINFIELD, NEW JERSEY

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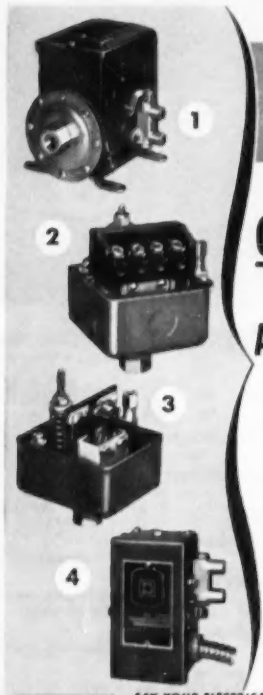


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## Complete Line

OF H.P. RATED

## AIR COMPRESSOR SWITCHES

1. Heavy Duty
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3. Gas Engine Cut-Out
4. Magnetic Unloader

full range of electrical and pressure ratings

*Write for Bulletin 550, Square D Company, 4041 North Richards St., Milwaukee 12, Wis.*

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

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# It's Bucyrus-Erie For the Tough Metal Mining Jobs

When the rich iron ore deposits of Cerro Bolivar mountain in Venezuela were discovered, Bucyrus-Erie 190-B shovels were selected to spearhead the job of excavation. Swinging 8-cu. yd. dippers, they keep a fleet of 20-cu. yd. carriers on the move.

The proved superiority of Bucyrus-Erie large-capacity excavators is the result of new front-end design, extra-strong construction, and advanced engineering throughout. Combined with the speed and smoothness of Ward Leonard electric control, these features offer performance that means higher output at the lowest cost per yard.

36L55C

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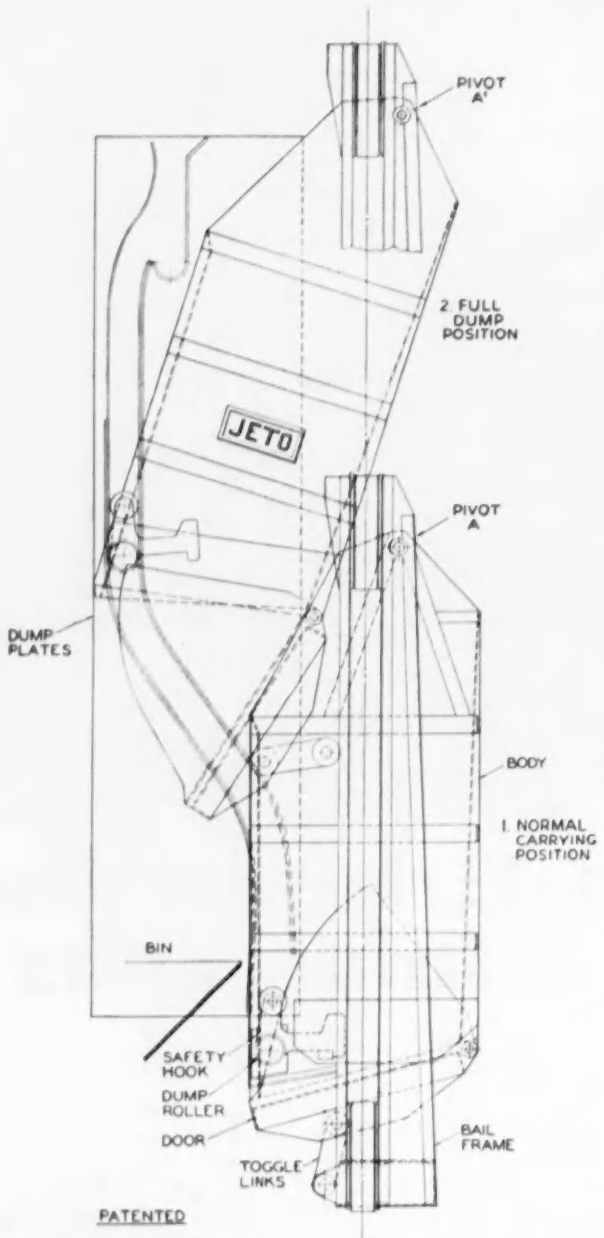
MOROCCO · PHILIPPINES · RHODESIA · UNITED STATES · VENEZUELA · ALGERIA · CANADA
INDO-CHINA · FRANCE · FINLAND · ENGLAND · CONGO
110-B 4½-cu. yd.
150-B . . 6-cu. yd.
190-B . . 8-cu. yd.
BUCYRUS ERIE

## Bucyrus-Erie Company

South Milwaukee, Wisconsin

# *Lake Shore's "JETO" bottom dump skip dumps 20% faster* — HERE'S HOW IT WORKS




*This engineer's drawing shows Lake Shore's "Jeto" bottom dump skip, 1. in normal carrying position, 2. in full dump position. The skip body swings outward from the bail frame on pivot point "A" while toggle links open the bottom door.*

### How the "Jeto" skip is made

The two principal parts of Lake Shore's "Jeto" bottom dump skip are the bail frame and the body of the skip. They move vertically in the shaft guides. When the dump position is reached, the body swings out and the ore is jetisoned. The dumping mechanism consists of a pair of dump plates (or scrolls) mounted at the dumping station, and dumping rollers, safety hook rollers, toggle door release links, all mounted on the skip.

### How it works

As the loaded skip moves into the scrolls, the safety hooks unlock the body from the bail frame, the dump rollers swing the body outward. With the outward movement of the body, toggle links attached to the skip door and the bail frame open the skip door and the ore is dumped. In full dump position, the door is in line with the back of the skip body, and the ore flows unrestricted from the skip. When the skip moves down, the same mechanism closes the door and swings the skip body back into the bail frame.

### Why the "Jeto" reduces ore handling costs

*"Jeto's" bottom dump is 20% faster than a Kimberly, means more skip loads per day.*

*Sticky ore dumps clean every time.*

*Full weight of skip is on the rope at all times —improves hoisting balance.*

*Positive door action prevents accidental dumping—safety hooks keep body locked in bail frame until dumping station is reached.*

When planning to replace a skip or to sink a new shaft, talk to the people at Lake Shore: Find out how the "Jeto" can reduce ore handling costs in your operation.

## LAKE SHORE, Inc.

Lake Shore Engineering Division

IRON MOUNTAIN 5, MICHIGAN



Circle 34A on reply card

Bethlehem Hollow in use on Northeastern Extension, Pennsylvania Turnpike, drilling crews are encountering heavy going after area was hit by hurricane rains.

# They Moved 1½ Million cu yd of Rock For Turnpike Link Near Allentown, Pa.

Work on a closing link of the first forty miles of the Northeastern Extension of the Pennsylvania Turnpike was completed recently, south of Allentown, Pa.

The 14-mile stretch of 4-lane highway, in the picturesque Spinnerstown-Quakertown area, consisted of three separate contracts, all held by C. J. Langenfelder & Son, Inc., Baltimore. Bethlehem Hollow Drill Steel, 1¼ in. round and fitted with detachable carbide-insert bits, was used in jackhammers and wagon drills as they went to work on 1½ million cu yd of medium-hard rock. The blast holes were 12 ft and 18 ft deep, with about half of the drilling taking place in water and mud seams.

Bethlehem Hollow Drill Steel can be counted on for steady, low-cost drilling because it is rolled from a tough, fatigue-resisting steel. It has a wide quenching range, making it easy to heat-treat for the ideal balance of hardness and wear-resistance. It also makes long-wearing threads and tough shanks.

Bethlehem Hollow comes in rounds, hexagons and quarter-octagons, generally in lengths of 18 to 25 ft, though longer lengths can also be furnished. It's good drill steel to keep in mind for your next rock-removal job, big or small.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM HOLLOW DRILL STEEL** CARBON AND ULTRA-ALLOY

BETHLEHEM STEEL

# MORE THAN 300 LEADING MANUFACTURERS

**are already putting**

# SKF TYPE "C" BEARINGS

**in their products**

Here are the trade marks of a few of more than 300 leading manufacturers – companies who want extra bearing performance – who already are using the *improved* SKF Type "C" Spherical Roller Bearing announced less than a year ago.

There are two reasons why

First: They know that for over 40 years, SKF has been *first* with anti-friction developments that *work*.

Second: They obtain, size for size, up to 50% more capacity, 2 to 3½ times increased life with SKF's Type "C" Spherical than they can obtain with any other available design, and at no increase in cost.

1550

**SKF INDUSTRIES, INC.**, PHILADELPHIA 32, PA.
– *manufacturers of* **SKF** *and* HESS-BRIGHT® *bearings.*

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**SKF®**

**BALL AND ROLLER BEARINGS**

12B LOADER

21 LOADER

40H LOADER

# THINKING OF REOPENING AN OLD PROPERTY?

Several good mining properties, unoperable only a few years ago, have taken on a new look with present day metal prices.

The cost of setting up to do business has many a mining man weighing the cost against the advantages.

New equipment available today offer many advantages for this work. The Eimco 630 crawler loader for trackless mining provides the ultimate in dependable loading equipment where it is not economical to relay track.

Investigate this sturdy loader — weight approx. 10,000 pounds — 3 tons per minute — operating and maintenance costs less than 1c per ton loaded.

**THE EIMCO CORPORATION**

**Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City**

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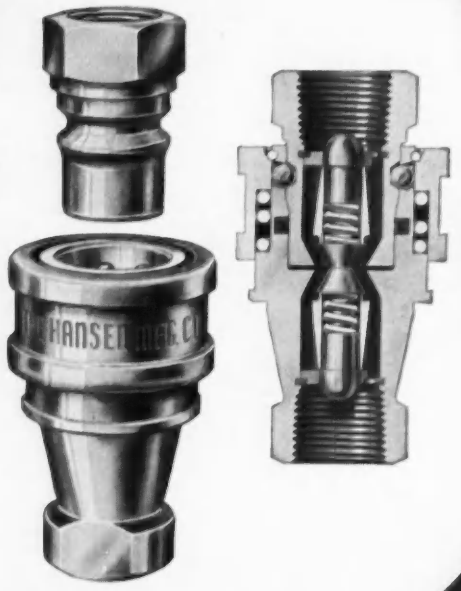
B-100

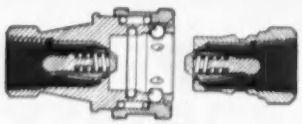
# HANSEN

## QUICK-CONNECTIVE 2-WAY SHUT-OFF COUPLINGS!



QUICK CONNECTION AND DISCONNECTION

INSTANT AUTOMATIC FLOW OR SHUT-OFF



***Seals Both Ends of Line***
**AUTOMATICALLY INSTANTANEOUSLY**

***Quick Connective Fluid Line Couplings for***

**AIR • OIL • GREASE • HYDRAULIC FLUIDS • REFRIGERANTS • STEAM VACUUM • OXYGEN • ACETYLENE GASOLINE • COOLANTS • WATER**

**HOSE CLAMPS • HOSE CLAMP PLUGS • HOSE CLAMP SOCKETS HOSE CLAMP COUPLINGS**

To connect a Hansen Two-Way Shut-Off Coupling, you just pull back the sleeve and push the Plug into the Socket. To disconnect, merely pull back sleeve. No tools required. Similar valves in Socket and Plug shut off both ends of line when Coupling is disconnected—practically eliminate spilling of liquid or escape of gas at instant of disconnection.

**FEMALE PIPE THREAD CONNECTIONS FROM ⅛″ TO 1″**

Hansen Series HK Two-Way Shut-Off Couplings are available with female pipe thread connections from ⅛″ to 1″ inclusive. Available in brass or steel.

*Also Straight-Through and One-Way Shut-Off Couplings. Write for Catalog.*

REPRESENTATIVES IN PRINCIPAL CITIES

**SINCE 1915** ®

**QUICK-CONNECTIVE FLUID LINE COUPLINGS**

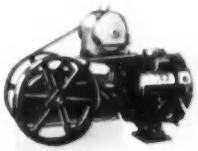
## THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 11, OHIO

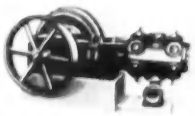
# Heavy-duty
# ES compressors

**provide maximum efficiency in a**
**WIDE RANGE OF APPLICATIONS**

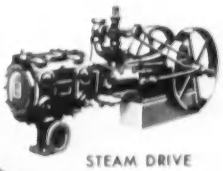
*. . . with unusual flexibility of drive and cylinder arrangements*



OVERHEAD MOTOR

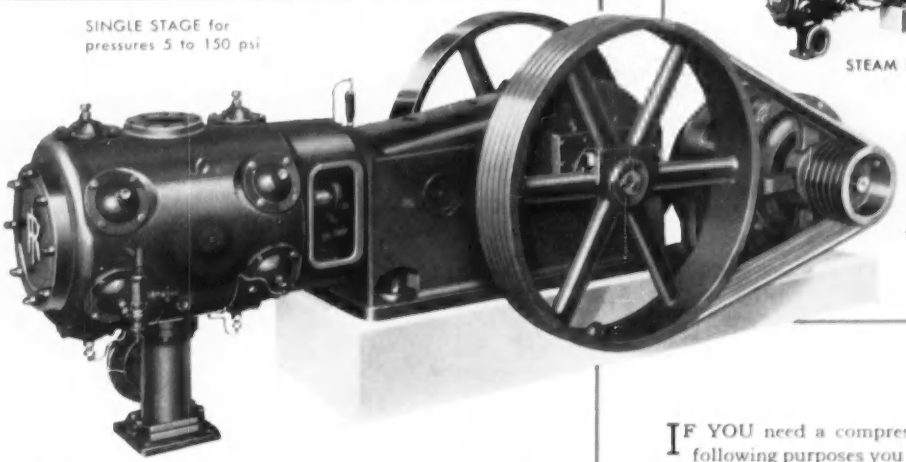


DIRECT-CONNECTED SYNCHRONOUS MOTOR

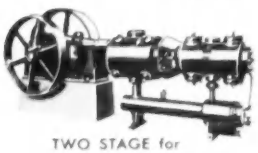


STEAM DRIVE

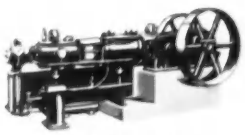
SINGLE STAGE for pressures 5 to 150 psi



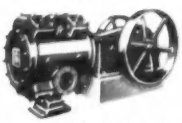
V-BELT DRIVE



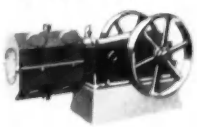
TWO STAGE for 150 to 500 psi



THREE STAGE for 500 to 2500 psi

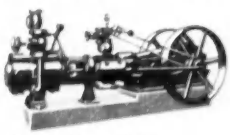


DRY VACUUM PUMPS . . . single or two stage



STEAM-PRESSURE BOOSTERS

NON-LUBRICATED CYLINDERS for oil-free air or gas



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IF YOU need a compressor for any of the following purposes you should consider the Type "ES" compressor . . . a standardized, yet extremely flexible compressor built by Ingersoll-Rand, the pioneer compressor builder.

- To compress air or gas to any pressures between 5 and 2500 psi, or for pulling vacuums. (Stock cylinders are normally available for all frame sizes, see illustrations.)
- For capacities requiring from 7½ to 150 horsepower. (Six frame sizes are available.)
- For continuous full-load operation day after day, week after week.
- For handling poisonous, inflammable, or other gases where leakage must be avoided.
- Where compressed air or gases must be free of all traces of oil. (Type NL cylinders require no oil, glycerine, grease or water for lubrication.)
- Where a future change in pressure conditions may call for a change in cylinder sizes.
- Where power cost is an important factor.
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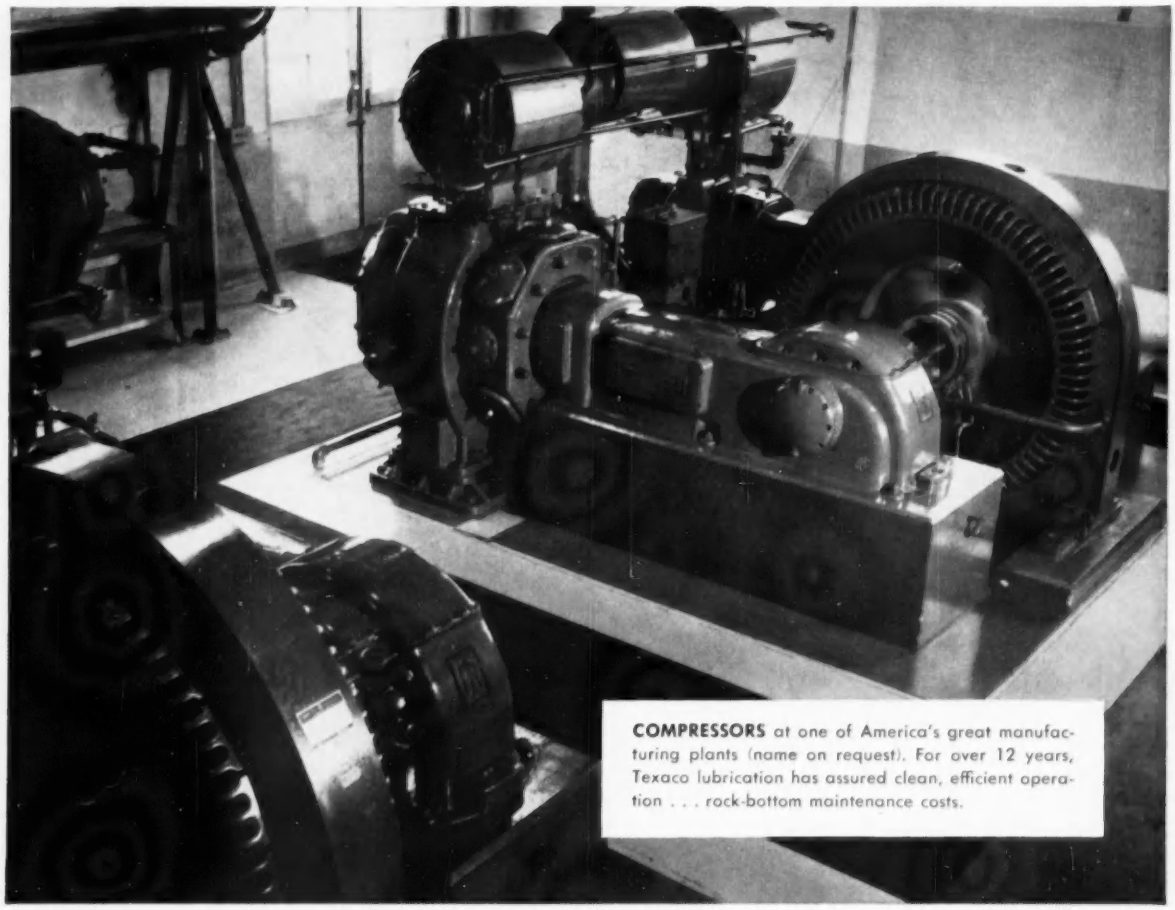

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